The Welding Engineer

Founded by L. B. Mackenzie, 1916

JULY, 1925 VOL. 10, No. 7

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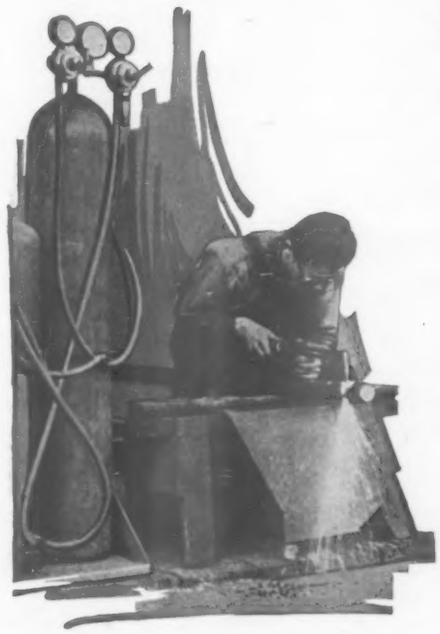

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Torchweld Equipment Co.
U. S. Welding Co.

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Carbic Mfg. Co.
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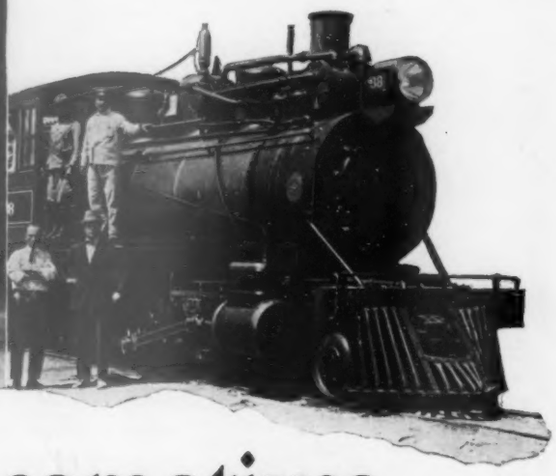

Rebuilding Locomotives

Here Are Jobs That Prove the Quality and Economy of WILSON WELDING WIRE

THE left hand illustration above shows how the Cuba Railroad extends locomotive frames, the work being done in its Camaguey shops. The right hand picture is of a locomotive built from spare parts and miscellaneous material by the Chaparra Railroad Company. This work was done in its Delicias shops, Delicias, Oriente, Cuba.

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Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.

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Air Reduction Sales Co.
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Linde Air Products Co.
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Imperial Brass Mfg. Co.
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Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
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Torchweld Equipment Co.
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Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.

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Carbic Mfg. Co.
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International Oxygen Co.
Imperial Brass Mfg. Co.
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Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
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ALPHABETICAL INDEX TO ADVERTISERS

A

Acme Electric Welder Co. 58
Air Reduction Sales Company....Front Cover
Allan Mfg and Welding Co. 58
The American Brass Co. 39
American Welding Society. 56
American Optical Co. 49
Alumino Thermic Corp. .....

B

Bastian-Blessing Co., The. 30-31
Bierman-Everett Fdy. Co. 58
Buffalo Dental Mfg. Co. 56
Burdett Mfg. Co. 11

C

Carbic Mfg. Co. .....Inside Back Cover
Central Steel & Wire Co. 53
Chicago Steel & Wire Co. 8
Chicago Eye Shield Co. 58
Commercial Acetylene Supply Co. 10
Alfred E. Corp. 58
Wm. Cramp & Sons. 51

D

Joseph Dixon Crucible Co. 52
M. Keith Dunham. 42-43

E

Elec. Arc Welding & Cutting Co..Back Cover

G

Gas Products Assn. 12
Gas Tank Recharging Co. 50
General Electric Co. 37
General Welding and Equipment Co. 54

I

Ideal Face Shield Co. 58
International Oxygen Co. 53
Imperial Brass Mfg. Co. 9

K

K-G Welding & Cutting Co. 56

L

Linde Air Products Co. 16

M

Manganese Steel Forge Co. 55
Metal and Thermit Corp. .....
Milburn, Alexander, Co. 49
Modern Engineering Co. 54
Morey Flux and Chemical Co. 57
Morris-Wheeler & Co., Inc. 57

N

National Carbon Co. 58
National Gauge and Equipment Co. 15

O

Oxweld Acetylene Co. 2

P

Page Steel & Wire Co. 54
Peerless Flux Co. 55
The Prest-O-Lite Co., Inc. 35
The Purox Co. 3

R

Reid-Avery Co. 52
Roebling, John A., Sons Co. 50

S

C. Sorenson. 58
Shawinigan Products Corporation. 55
H. E. Steinbock. 58
Stoody Co. 54-58
Superior Oxy-Acetylene Machine Co. 57
N. A. Strand & Co. 58

T

Torchweld Equipment Co. 51
Todd Shipyards Corp. 13

U

Union Carbide Sales Co. 7
U. S. Gauge Co. .....
U. S. Light and Heat. 47
United States Welding Co. 57

W

Westinghouse Electric Mfg. Co. 58
Wilson Welder & Metals Co. 5
Willson Goggles, Inc. 56
Wodack Electric Tool Corporation. 48
Wm. Wharton Jr., Co., Inc. 57

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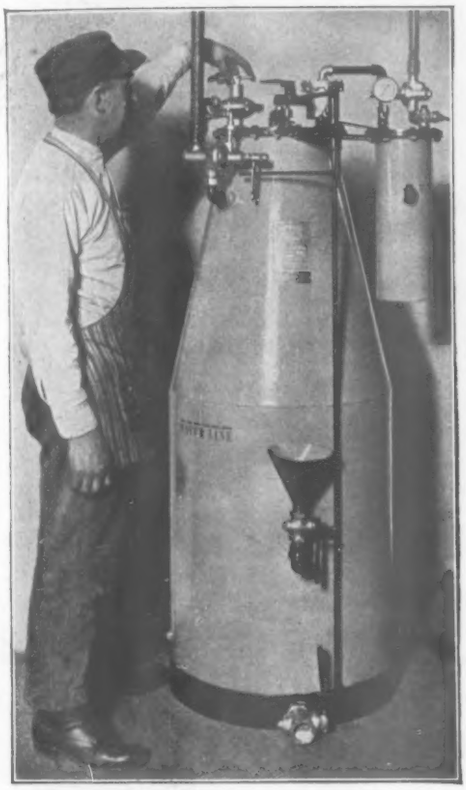

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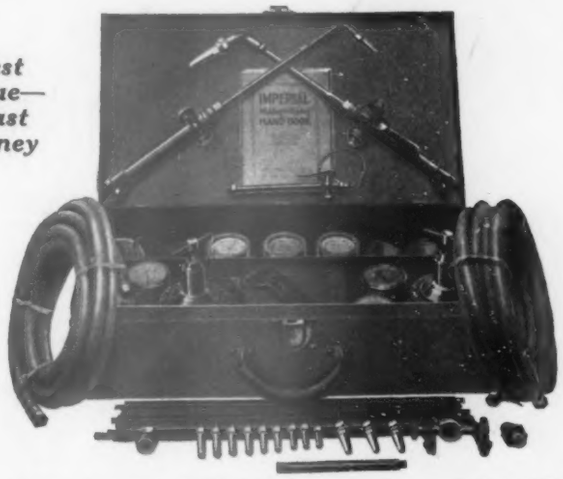

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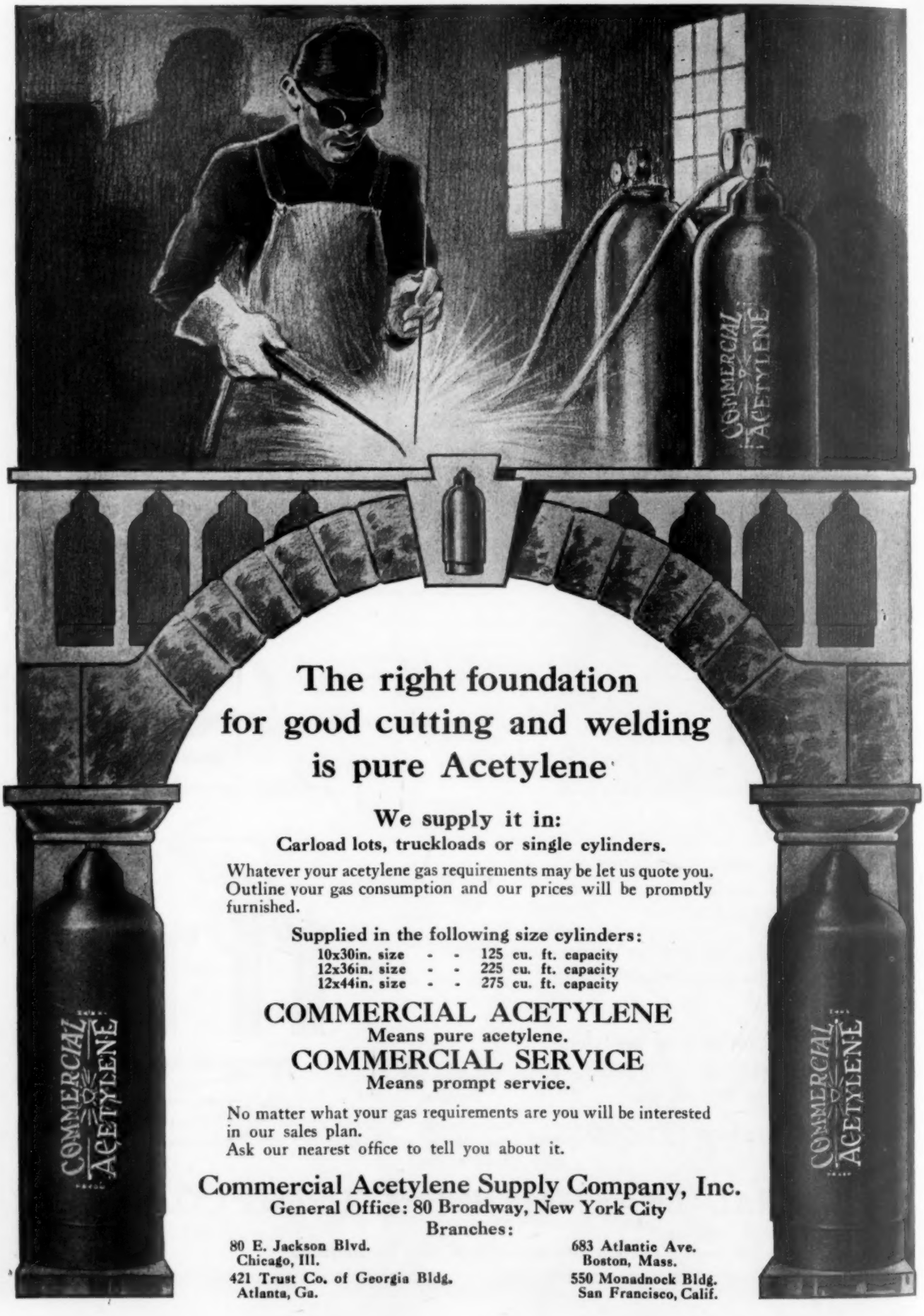

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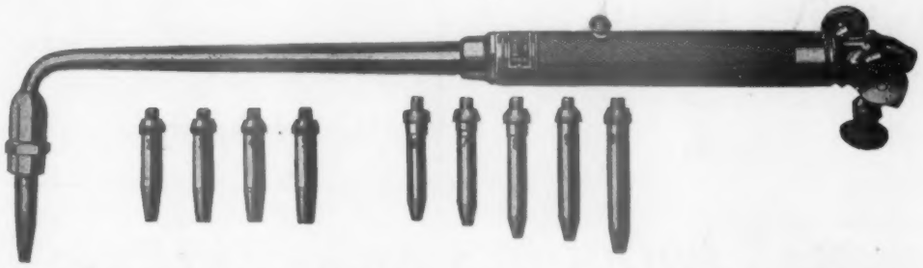

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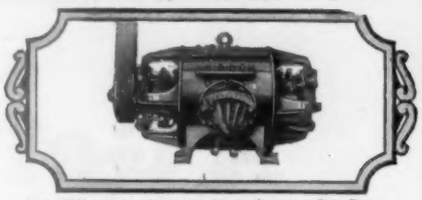
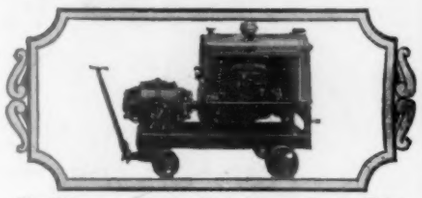
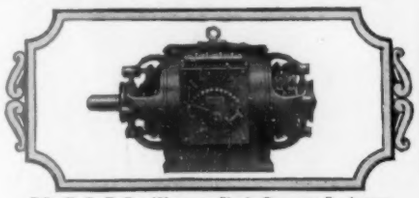


ER—1200 r.p.m.—200 amp.—Single Operator Belt Driven
Length, 33 5-8 inches Diameter, 16 1-8 inches
Net weight, 611 pounds Shipping weight, 680 pounds

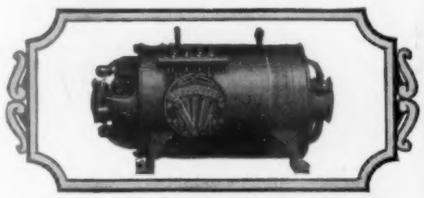


ER—1200 r.p.m.—150 amp.—Single Operator Gasoline Drive
Length, 74 inches Width, 39 inches Height, 60 inches
Net weight, 2475 pounds Shipping weight, 2775 pounds

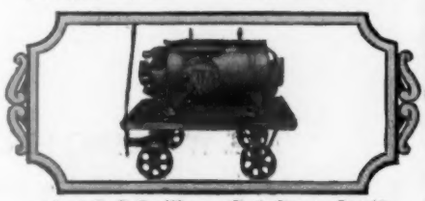


DR—D.C. D.C.—150 amp.—Single Operator Stationary
Length, 33 5-8 inches Diameter, 16 1-8 inches
Net weight, 611 pounds Shipping weight, 680 pounds

DR2—D.C. D.C.—200 amp.—Single Operator Stationary
Length, 35 1-8 inches Diameter, 16 7-8 inches
Net weight, 650 pounds Shipping weight, 710 pounds



AR—A.C. D.C.—200 amp.—Single Operator Stationary
Length, 38 inches Diameter, 17 1-8 inches
Net weight, 765 pounds Shipping weight, 840 pounds



AR—A.C. D.C.—200 amp.—Single Operator Portable
Length, 36 inches Width, 24 inches Height, 12 inches
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G-5

Welding the Ornamental Iron Product

The Oxy-Acetylene Torch Is an Indispensible Tool Both in the Shop and in the Field

By B. Heyman*

IT IS to be expected that wherever iron is fabricated there will be found numerous uses for the oxy-acetylene torch—both welding and cutting. This is true, regardless of the fact that production or repair work is carried on by means of machines especially adapted to the work.

Hand Wrought Figures Welded to Railing Panels.

In the ornamental iron shop, and in the field work which results from erecting such iron shop products, the torch is not merely a useful adjunct. At times it becomes an absolute necessity, as for example, where holes must be cut, or a steel member cut to length.

One of the most important branches of iron shop manufacture is that which pertains to fence construction. It might be assumed, that, owing to the methods, in vogue, there would hardly be any use for oxy-acetylene apparatus, due to the nature of the work, and its particular requirements. Yet, in certain special classes, the welding torch is indispensable. In fact, without it, the expense of manufacture would become almost prohibitive.

Any fence has a double duty to perform. First, it must safeguard the particular property around which it is located, and second it must add to the appearance of the locality or the grounds.

That the day has passed when fences of board or wooden pickets were deemed sufficient protection is apparent and evidenced by the extent to which improved types of iron railing are being adopted by many industries and innumerable private individuals.

In the case of an industry where length of service is of prime importance and depreciation is a deciding factor, the durability of any equipment comes into consideration. Officials of such organizations have naturally turned to heavy iron railings or heavy chain link fences. As an instance, may be mentioned the large railroad companies which must protect not only their "right of way," but must also enclose their railroad terminal yards, buildings, repair shops, etc. Adequate "right of way" is of vital importance to both the public and the railroad when the tracks run through urban or suburban sections at or near grade level. Such protection must be of a type which will discourage the climbing instinct of any individual and must be equally effective in resisting the destructive elements year after year.

For safeguarding the public around railroad depots, and where tracks run through congested districts in cities

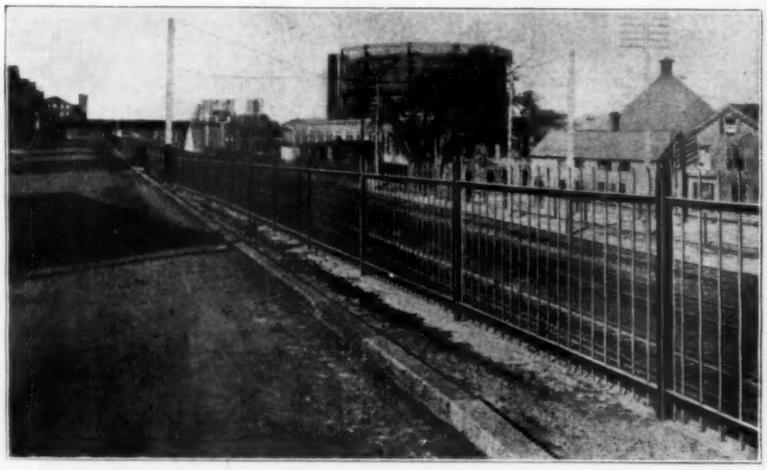
Anchor Post Iron Works, Garwood, N. J.

and towns, a number of important railroads have adopted a heavy and substantial iron railing. The picture on this page shows part of an installation of Anchor Post Iron Railing furnished for the New York, New Haven and Hartford Railroad and erected in Pawtucket, R. I. The posts are 3-inch I-beams and the rails 2-inch x 2-inch channels.

At the Jersey City terminal of the Central Railroad of New Jersey there is an installation of 6,300 feet of Anchor Post Intertrack Fence, a part of which is shown in the accompanying photograph.

Such a case is shown in the figure at the head of this article in which a special railing was designed to enclose a small estate. The railing was to have every protective feature and at the same time was to incorporate the effect of a grape arbor, vines, leaves, grapes in branches, even to the finer tendrils curling around in small volute curves.

How well the iron worker performed his work is indicated in the photographs of the completed product. The leaves, vines, grapes, etc., were hammered by hand and then assembled by oxy-acetylene welding, the entire



Fence Built for N. Y., N. H. & H. R. R.

Hair Pin Fence at Jersey City Terminal.

The fence is built with I-beam posts, steel channel rails and "hair-pin" pickets. It is provided with a number of self-closing, sliding gates, two feet wide, enabling the car cleaners to pass from one track to another. This fence is one of the conspicuous features of the station, where every part of the equipment is the best and most modern of its kind.

Iron Railings are manufactured by an electric welding process, which insures an unequaled degree of strength and durability.

In railings made by the process, the pickets and rails are made of grooved square rods, which are welded together at every intersection. This process will be described in a later article.

On the other hand, where the protective means are employed around an estate or residence, it is especially required that in addition to the foregoing, that the equipment harmonize with the surroundings or at least must not detract from the appearance of the grounds.

Where such is the case the landscape architect generally co-operates with the iron worker to turn out a product which would appear practically impossible except in one's imagination or on paper, and yet is made real, due to the possibilities of the oxy-acetylene welding torch and the art which has developed since the inception. Actually, there are many cases of elaborate fabrication by other methods, all of them so costly and intricate as to be beyond the means of the average individual.

vine being built around the railing panels which had already been assembled. For this work, naturally, very little filler rod was required, most of the work consisting merely in fusing the joints, but this was of necessity, of a delicate nature, and demanded a skilled operator who could join the parts rapidly and at the same time overcome the surface scale which had resulted from the forging of the separate parts.

Simple as the work itself might appear, yet the demands made upon it required that the welder be a skilled operator on steel. Such a fence must be able to withstand more than ordinary abuse and it is to be expected that any attempt to climb over the welded sections will show the effect on any weak joints that may be incorporated.

This is only one of many examples that occur in the daily routine of such a shop, but it is a fine example indicating how the torch has adapted itself to unusual applications.

KLAPPERTZ COMPANY CHANGES HANDS

The original Kappertz Welding Works has recently been taken over by the Morristown Welding and Radiator Company, Inc. It will in the future be known under the new name. The original business was started in 1914 and this is one of the oldest welding shops in the northern part of New Jersey. The oxy-acetylene, electric and thermit processes are all used and the shop is equipped to do any kind of welding anywhere. In addition to being an all-around welding shop the Morristown Welding and Radiator Company, Inc., is especially equipped to give repair work and service to all types of radiators.

Arc Welding in Ship Building*

Amount of Labor Required for Welding Is Considerably Less Than for Riveting—Welders Learn Best Methods Easily

By W. Strelow, Hamburg

METALLIC arc welding to the Slavianoff procedure has a number of merits, that make it especially suited for application in shipbuilding; especially since it can be done in any position of the parts that are to be welded. Compared with riveting, the most important advantage of fusion welding is that the connection is a direct one and that the welding material is intimately connected with the building material. Therefore, the strength of the connection can be made equal to that of the section of the connected parts; while riveting, as applied in shipbuilding generally, has a strength of only about 70 percent of the normal sections. The labor of welding is considerably less than that of riveting. If all details, including mould work, are considered, a rough calculation based upon practical experience shows a relation of welding labor to riveting labor of 1:4 for a seam of a ⅜-inch plate for butt welding. Also a very decided saving of material is effected.

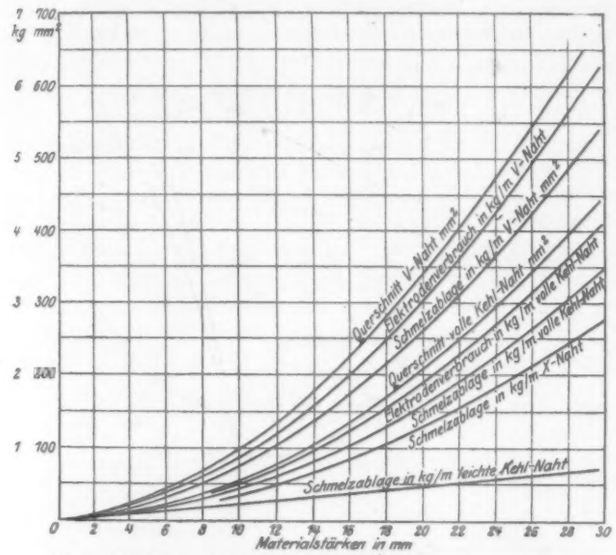

kg mm²
Querschnitt V-Naht mm²
Elektrodenverbrauch in kg/m V-Naht
Schmelzablage in kg/m V-Naht mm²
Querschnitt volle Kehl-Naht mm²
Elektrodenverbrauch in kg/m volle Kehl-Naht
Schmelzablage in kg/m volle Kehl-Naht
Schmelzablage in kg/m X-Naht
Schmelzablage in kg/m leichte Kehl-Naht
Materialstärken in mm

Abb. 22. Schmelzablage und Elektrodenverbrauch bei verschiedenen Materialstärken.

Fig. 1

TABLE OF TRANSLATION FOR FIG. I (Abb. 22).

Querschnitt V-Naht, mm²
Section of V-seam in mm²
Elektrodenverbrauch in kg/m.V-Naht
consumption of electrode material in kg/m. for V-seam
Schmelzablage in kg/m.V-Naht mm²
Weld material deposited in kg/m V-seam
Querschnitt volle Kehlnaht mm²
section of full welded throat (?) seam mm²
Elektrodenverbrauch in kg/m. volle Kehlnaht
consumption of electrode material in kg/m full welded throat (?) seam
Schmelzablage pr kg/m. pro volle Kehlnaht
weld material deposited in kg/m full welded throat (?) seam
Schmelzablage kg/m. X-Naht
weld material deposited in kg/m X-seam
Schmelzablage kg/m. leichte Kehlnaht
weld material deposited in kg/m light welded throat (?) seam
Materialstärken in mm
strength of welded material in mm

Schmelzablage u. Elektrodenverbrauch bei verschiedenen Materialstärken
Amount of deposited weld material and consumption of electrodes at different thickness of material.

*Extract from a paper read at the 25th annual meeting of the Schiffbau-technische Gesellschaft in Berlin, November 20th-22nd, 1924.

In spite of these advantages, there have been experienced difficulties in the introduction of arc welding, because construction and workmanship demand new methods. Practical investigations and applications of arc welding for ship building purposes have supplied the author with the material to give a review on all questions connected with arc welding for shipbuilding purposes.

It is the advantage of arc welding, that the arc takes the material from the electrode to the working piece, so that both overhead and vertical welding may be done with it; a fact, that is of special advantage for shipbuilding purposes. Practical experience shows that the effect of arc welding is different on sheet iron of different thickness. In the case of sheet iron the effect goes more into the depth because the heat is led away more slowly. Care must, however be taken, not to apply too strong currents, or the material deposited will be burnt. Really the selection of the strength of current is of highest importance. It depends on the length of the arc and the voltage; therefore, the skill of the welder in keeping the best length of an arc under the prevailing conditions influences the quality of the weld. Currents from 150 to 180 amperes have been experienced to give the best results at 18-20 volts. The direction of the arc, however, is unfavorably influenced by the parts that are to be welded, under certain conditions, and care must be taken to avoid this wherever possible.

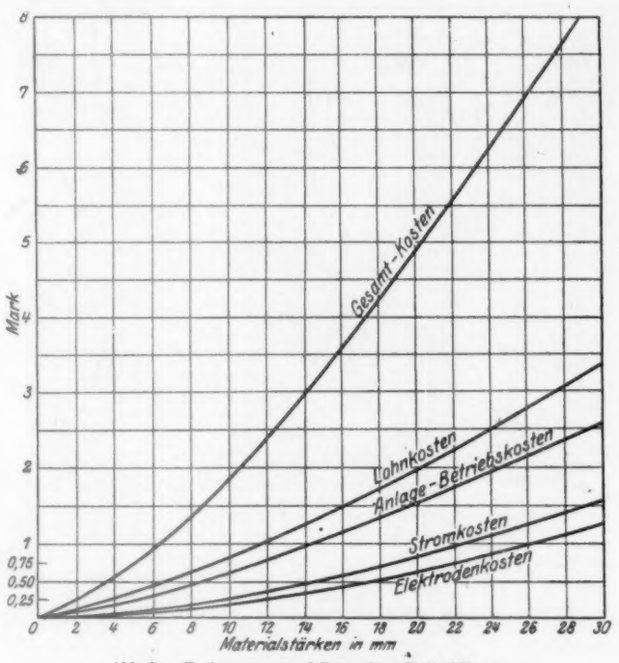


Abb. 24. Kostenzusammenstellung einer V-Naht/lfd. m.

Fig. 2.

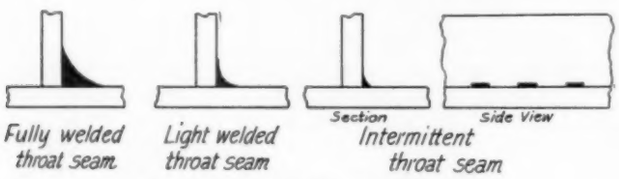
TABLE OF TRANSLATION FOR FIG. II. (Abb. 24).

Gesamtkosten.....Total costs
Lohnkosten.....Wage costs
Anlage-betriebskosten.....Costs of equipment
Stromkosten.....Costs of current
Elektrodenkosten.....Costs of electrodes

Kostenzusammenstellung einer V-Naht/lfd./m.
Different costs of V-welded seam per meter.

The selection of electrode material is likewise a matter of great importance. It must be of homogenous quality, free from gas pockets and slag. The analysis is of not so much influence. Covered electrodes have the advantage that unexperienced welders can work with them, but there is the danger that the coating material remains in the weld and destroys its strength. Therefore bare electrodes are preferred by many. The holders for the electrodes and the cables must be as light as possible, in order to allow easy manipulation.

It has been our experience that it is of little use to specify a special carbon percentage in the electrodes, as the carbon burns entirely in the arc, so the material deposited is practically carbonless. Such iron material should, according to normal experience, have inferior strength and greater ductility than shipbuilding steel. But the momentary cooling of the welded section, caused by the heat transmission to the neighbored parts, has the opposite effect of greater strength, brittleness and small ductility. The strength may, however, be reduced



Weld Designs Referred to in Figs. 1 and 2.

by oxides and slags that get into the weld through careless work. Breaking tests of well welded parts have given about the same strength as is normal with shipbuilding material, but the ductility is decidedly smaller and has a maximum value of 14 percent. For practical shipbuilding this is not of much importance, as there are always the normal constructional parts, which can take up the effect of collision or similar

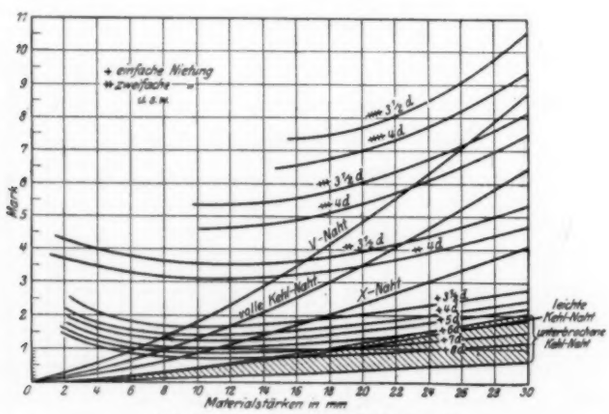


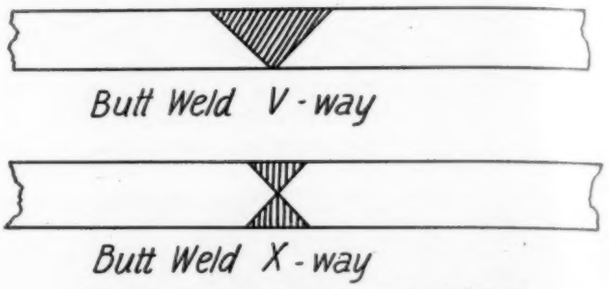
Abb. 25. Kosten von Schweiß- und Nietnähten/lfd. m.

Fig. 3.

TABLE OF TRANSLATION FOR FIG. 3. (ABBILDUNG 25)
+einfache Nietung = +single riveting.
++zweifache Nietung = ++double riveting.
u. s. w. = and so on.
V-Naht = V-seam.
Volle Kehlnaht = full welded throat (?) seam.
X-Naht = X-seam.
Leichte Kehlnaht = light welded throat (?) seam.
Unterbrochene Kehlnaht = Intermittant throat (?) seam.
Materialstärken in mm. = strength of material in mm.

Kosten von Schweiss-und Nietnäthen lfd/m. = costs of welded and riveted seams per m.

stresses. For safety's sake the butt welded parts may be welded about 5 or 10 percent thicker than the normal plates. The results of breaking tests made with butt welded strips of plates are given in Table I. There is no doubt, however, that the quality is enormously dependent on the capacities of the workman. Careful teaching is necessary. The welder must be able to judge his art by the eye, by the hand, by means of the attraction of the electrode by the welded parts and by the ear, as the voltage and current influence the sound of the arc. The art of welding requires years of study, and the men must be specialized for different kinds of arc welding. It is often possible to make out the quality of a weld after it has been finished, by the irregularities of the top layer.



These Terms Refer to Single and Double Bevel

The economy of arc welding is much influenced by the fact, that preparative work is so small compared with riveting; also caulking is dispensed with. As concerns material consumption and wages, they are directly dependent on the amount of material that must be deposited. Butt welding may be done with either a single or double bevel. The double bevel requires much less material, but it requires overhead work, which is impracticable in shipbuilding. Figure 1 shows the material consumed for different kinds of preparation, de-

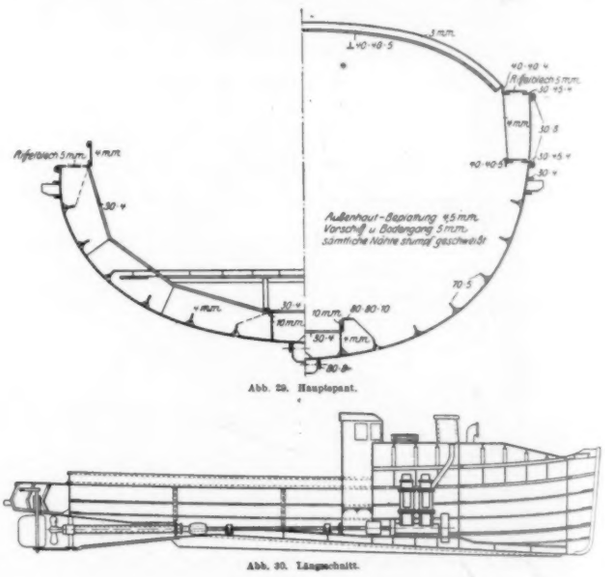


Abb. 29. Hauptspant.

Abb. 30. Längsschnitt.

Fig. 4.

TABLE OF TRANSLATION FIG. 4. (ABB. 29 AND 30)
Riffelblech = rippled sheet iron.
Aussenhautbeplattung = shell plates.
Vorschiff und Bodengang = plating of foreship and bottom strake.
Sämtliche Nähte sind stumpf geschweisst = All seams are butt welded.

Hauptspant = Midship section.

Längsschnitt = longitudinal section.

pending on the strength of material. With an electrode of 3 millimeter diameter (⅛ inch) about 0.55 kg. (½ lb.) may be deposited per hour and double this amount may be deposited with a 6 millimeter electrode. The total costs of a single bevel butt welded seam are shown in Figure 2. A comparison of the costs of welding and different kinds of riveting is given in Figure 3.

Practical application of arc welding for shipbuilding purposes naturally requires special method of construction. The

author has developed a special one, in which the shell of the vessel is stretched horizontally at first on a plane. The plates are then butt welded. Follows the fixing of the frames, either to the longitudinal or transverse system. They consist merely of flat irons set vertically against the shell plates and welded intermittently on both edges against it. With the transverse system, the bilge parts of the frames are left unwelded. Then

Fig. 6.—Inside View of Barge.

the sides are bent upward to the bulkheads which give the form if the longitudinal system is applied. A motor boat 46 feet long, shown in Figure 4 and some barges of 53 feet long, have been built with this system; the motor boats has a shell of 4.5-5 millimeters (0.18-0.2 inch) and longitudinal frames; the barges a shell of 0.28 millimeters and transverse frames. In both vessels the advantages of reduced work and reduced material have been fully experienced and the costs of building were much smaller than with riveted craft. One of the most important things for the future development of arc welding in shipbuilding is to create a good number of well and systematically trained workers. Also, by further investigations and by improvement of the arc welding apparatus the development of welding can be promoted, so that it may completely replace the riveting process.

TABLE I

Breaking tests with test pieces with V-butt weld

Thickness mm	Breadth mm	Section mm²	Breaking strength kg/cm²	Strength in per cent of ironpiece	Remarks
11,0	30,0	330	4300	.....	non welded piece
10,8	30,0	324	4000	93,0	
10,7	30,1	322	4190	97,5	
19,4	30,0	582	3620	.....	non welded piece
19,4	30,3	588	3640	100,0	
19,6	30,1	590	3580	99,0	
19,0	30,3	575	3730	100,0	Piece broke at other place than weld
19,4	30,0	582	3650	.....	
18,0	30,0	540	4400	.....	non welded piece
18,3	29,9	547	4060	92,5	
18,3	29,2	545	4115	93,5	

J. F. LINCOLN TO VISIT ENGLAND

Mr. J. F. Lincoln, vice-president of the Lincoln Electric Company with main offices and factories at Cleveland, has just left on a business trip to England. During his stay in that country he will visit the main industrial centers and make a study of expert possibilities and general business conditions. Mr. Lincoln will make his headquarters in London at the offices of the Lincoln Electric Company distributors there, while in England. Through the trip it is planned to extend the facilities of the American company for supplying its products to Great Britain. Especial attention is to be given by the Lincoln Electric Company official to the marketing possibilities for the induction motors and different sorts of welders manufactured.

WELDING IN SPAIN

Welding progress in Spain has been so satisfactory in recent years that there has finally resulted sufficient interest to justify the publication of a trade paper on welding for that country. The name of the new paper is La Soldadura Autogena. This paper has the backing of the firm of Autogena Martinez, Madrid, which is probably the largest welding and welding supply house in that country.

A Group of Government Officials Visiting the Booth of Autogena Martinez.

On the occasion of a recent Spanish General Exposition of Building and Construction, this firm had a very complete and attractive booth for the exhibition of welding apparatus and supplies of all kinds. In the course of the exhibition demonstrations of welding were given here to show how the process results in economy in metal construction.

How Equipment is Displayed in Spain. The Booth of Autogena Martinez

Adjustment of the pressure is the next important element which must be considered in electric resistance welding and too much emphasis cannot be placed on this particular function. The heavier the metal the more pressure is necessary, especially where the metal is somewhat scaly. If too many sparks are flying from the weld you have a certain indication that too little pressure or too much current is used and unless the proper regulation is made the results of the welding will not be satisfactory. It is well to note here that when welding galvanized iron, brass, tin and coated stocks less pressure and more current is required.

Welders — and Proud of It

Strength and Tightness of Welded Joints Being Widely Advertised to Engineers and Purchasing Agents

WELDED joints are better joints, is the claim of many leading American manufacturers, and this claim is being published far and wide through the pages of the trade and technical press. After long and successful experience, these manufacturers are so thoroughly convinced of the superiority of the welded product that they are spending thousands of dollars to tell the public about their preference for welding.

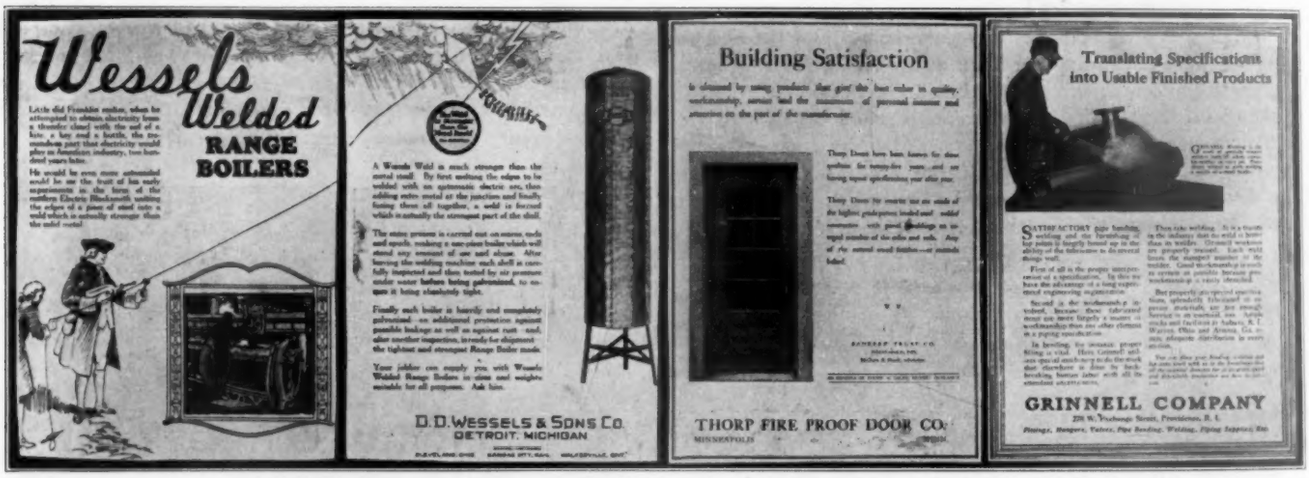
An interesting collection of such advertisements is shown in reduced size on the opposite page. In several of them it is apparent that great care has been exercised to bring the weld out strongly in display, making it the most prominent feature of the advertisement. The Wessels advertisement (on this page) in the original is a double page spread in two colors. It is almost entirely a tribute to the efficiency of the welded joint, with the slogan, "The weld is stronger than the metal itself," prominently displayed. Wessels boilers are offered as a distinctly superior product because the makers know how to do good welding. The rugged appearance of the weld in the closeup, which is a feature of the Vogt advertisement, inspires confidence in this kind of construction, where welding and riveting are combined. Welded headers such as those shown in the display of the Pittsburgh concern are not a novelty, by any means, for it is common practice to weld these in the largest refineries, but the engineer who sees the picture cannot fail to be impressed with the value of a process which is satisfactory for use on such important constructions. It is also impressive to see welding featured by a concern of such national prominence as the Grinnell Company.

From the two groups of advertisements which have been selected to accompany this article it will be seen that there is no limit to the variety of metal containers and pipe shapes which can be and are being fabricated by welding. It is possible to find examples of welded production featured in other fields of advertising, of course, but space will not permit a much larger showing. The door advertisement has been included because it carries the message of welding into the refined atmosphere of a paper which serves the highest class of architects.

All advertising of this sort is directly beneficial to the welding industry. Especially so because all of the examples shown have been clipped from trade and technical journals, publications which are read by the most progressive and probably the most prosperous men in the country, men who are looking for new ideas and new processes.

Welding has likewise had the benefit of advertising in what are known as general publicity media. Hess furnaces make their appearance regularly in the Chicago Tribune daily and Sunday editions. And the Lincoln Electric Company has used the Saturday Evening Post to tell the story of how welding improved the construction of Lincoln motors. So millions of readers have come to know that a welded joint in a metal product is something to boast about.

Because welding has made good, from a cost standpoint, from a service standpoint, from a safety standpoint and from an efficiency standpoint, these voluntary tributes are daily being paid to the process. The question, "Are welding failures due to welding?" finds its answer in the advertisements reproduced on these two pages.



The First Two Pages Shown Here Formed a Double Spread Which Was Printed in Two Colors.

GRAVER BUILT
Graver Builds
WELDED TANKS BY THE CARLOAD
There is a mighty good margin in retailing tanks for domestic oil burners.
Buying these tanks from Graver in carloads you save in two ways—
There is an extra discount
Freight is practically one half
and Graver makes all the necessary fittings for oil burner installations.
GRAVER Corporation
EAST CHICAGO, INDIANA
SUPER STRENGTH
OF RIVETED-WELDED JOINTS
All joints of Vogt High Pressure Stills have the combined tightness and strength of riveting and welding which prevent leaks. This construction gives the advantages of both which has proved to be the best for high pressure and temperature work. The Vogt Stills and Special Refinery Equipment have won the hearty endorsement of leading refinery engineers for remarkable service.
A VOGT RIVETED—WELDED JOINT
Vogt St
HENRY VOGT MACHINE CO.
LOUISVILLE, KY.
Welded Work
Power Piping Co.
631 Beaver Ave., N. S.
PITTSBURGH
COMPLETE FABRICATION ERECTION
VALVES FLANGES FITTINGS
Power
The Hess Welded Steel Furnace
BURNS ANY FUEL - BURNS IT CLEAN
SAVES ALL THE HEAT
MADE IN SIX STANDARD SIZES
PIPE AND PIPELESS
THE HESS PIPE FURNACE
300-350-400 Gallon MULLINS
SUPER-WELDED Truck Tanks
Quantity Production — Low Price
Carried in Stock — Immediate Shipment
MULLINS BODY & TANK CO.
47th Ave. & Rogers St. Milwaukee, Wis.
The Name Plate Is
Weldco's Guarantee
WELDCO
TRUCK TANKS
The Youngstown Welding Co.
Welders since 1912
Youngstown Ohio
ADAMSON
WELDED TANKS
HEGGIE-SIMPLEX
[FORMERLY SIMPLEX]
ELECTRIC-WELDED STEEL BOILERS
Saves
INSTALLATION TIME and COST
FUEL—and FIRING LABOR
BOILER SPACE and INSURANCE
In the heating field, "Heggie-Simplex" is the outstanding example of what modern scientific knowledge and standard practice can accomplish. It reduces the heating problem to its simplest terms—assures more economical and reliable heat for buildings of all classes. In it are combined all that is most modern and approved in boiler design—thorough combustion, large direct heating surface, free circulation of water, triple gas travel, easy installation and maintenance, long life.
WRITE for detailed information and the experience of Heggie-Simplex users
HEGGIE-SIMPLEX BOILER COMPANY, Joliet, Illinois
Range Boilers
Riveted
Welded
Sure-Tite
Wm. B. Scaife & Sons Co.
Pittsburgh, Pa.
WACKMAN
Welded Delivery Cans
Thoroughly Leak Proof
Heavy and Rugged
Well Built
Well Proportioned
5 gallons
15 gallons
Screw Plug Top or Friction Top
Generous Opening
Easy to Handle
True Capacity
STEEL BARRELS — WELDED UNDERGROUND TANKS
DELIVERY BUCKETS — MEASURES — FUNNELS
WACKMAN WELDED WARE CO.
7th and Victor Sts. St. Louis, Mo.
Experienced Users Select
BUTLER Tankers!
here is why—
DERBY OILS
Lacquer Enamel
Derby Oils Butler lacquer enamel finish—smooth, satiny, easy to keep clean, unaffected by grease, acids, etc. "Doesn't get old with age."
Outside Welding
White Eagle knows Butler welded seams are dependable—strong, smooth, flexible, easily reached, accessible from the outside.
Correct Design
Pure Oil requirements are filled completely by Butler design—sturdy, massive, dependable, yet flexible under strenuous service, demanded by heavy deliveries.
Adjustable Sills
Monark can change sills for any width chassis. Butler sills have 12-inch adjustability—takes care of chassis from 30 to 42 inches wide, inclusive.
MONARK
Emergency Valves
In addition there are Butler Emergency Valves, automatic and internal. Butler Tanks therefore are more than attractive and handsome, dependable and sturdy and flexible. They can and do "give more" because they have more to give. Get complete Butler details before you specify a single tank.
Butler Manufacturing Co.
Kansas City Minneapolis

Nationally Known Firms, Proud of Their Welding Departments.

Gas Welding Locomotive Frames

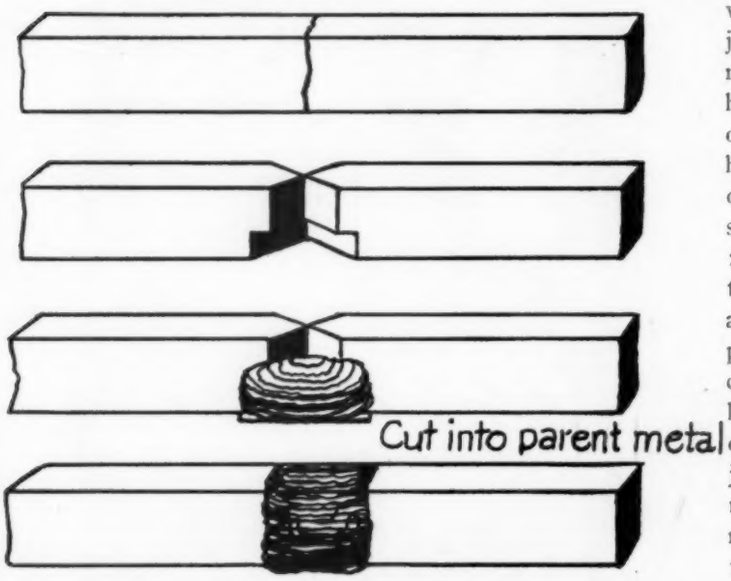
Best Results Come from Using Two Welders at Once on Frames—Vanadium Rods Recommended for Filler

By R. P. Palmer

(*Continued from June issue*)

"WELL, last but not least is the Oxy-acetylene process."

The host and I were both for Oxy-acetylene and he invited me to present my argument first and he would be second, but Thermot and Electric objected to allowing two of us to present the gas argument as they said there was only one each for the other methods; so the host asked me to defend the gas side, but I had to refuse because the host was a very good speaker having been an auctioneer, lawyer, and welding equipment salesman and he agreed to defend our side and began like this:



"First, I want you to allow me just a few words of introduction before we start welding a locomotive frame. I want to tell you what gas will do and what it won't do.

"First: You can take the acetylene outfit to the job regardless of where it is and you do not need to have any wiring, bees' wax or molding sand. Neither does it take us three hours to get a frame hot. We have the job complete in that time.

"Both of the previous processes have to use a gas cutting torch to prepare their work. You have to have a supply of gas on hand so you might as well just use this gas to do the welding.

"We don't have to wait two or three hours after the job is welded to remove the wedge used to spread the frame; neither do we have to wait until morning to remove the box and sand. And again you must have an Oxy-acetylene cutting torch to cut the riser and pouring gate. This proves that neither of you fellows can get along without our process. We can do any job with our acetylene that you can do with your processes and we can do it better and quicker. 'Yes' we can weld flues with gas, but we use another process. Just so you will have a job. There is no job too big or too small. I welded a gold ring for a fellow the other day and you could not find the place where it was joined after being polished. Can you do this with your welding processes? Our cast iron welds are machinable and, by the way, they are also leak-proof. There is strength in our welds. You can't call that welding when you use studs, which are mechanical joints, and when we finish a cast iron job the parent metal and adding metal is all cast iron weld. You have several different kinds of metal. At the line of fusion on the cast iron (parent metal) side you have a semi steel casting and at the line of fusion on the steel side (adding metal) you have high carbon steel, because the steel adding metal absorbs carbon from the cast iron. You can see how that conglomeration will machine. Of course, you can use a nickel alloy but you don't get good penetration. You just put that stuff on there to occupy space. You weld copper and brass with electric, sure you do, but you have to preheat it and, with the welding torch we do our preheating as we do our welding. We can do a job by the time you get your preheating done. I am not telling you fellows this to make you sore. There is nothing personal about it but I am just trying to prove to you that my process is best. I will admit that there is a very large field for all three of us. Each process has its own particular place.

"Well, I suppose you fellows are tired of sitting there and listening to me knocking you, so I will proceed with the frame.

"First, as in the Thermit and Electric processes, we tram our frame, next—remove all parts that might interfere with the welding.

"We now spread the frame. For a 4x4 inch, we usually spread it 5/16 inch. This will allow it to be about $\frac{1}{16}$ inch long when complete. Next, we double V the frame, the V being two inches wide at outside and two inches deep at the bottom of the frame. We make the V slightly wider, usually about three and one-half inches. This extends up the V one and one-half inches, thus allowing for a good start and as the weld progresses up to the smaller part of the V, we work this metal into the weld. When completed the

weld is about three and one-half inches wide up the entire length of the side.

"We always work two welders, one inside and one outside, being careful that one side does not progress ahead of the other. We use vanadium rods for adding. We always reinforce about 25 per cent up the side of the frame, being careful to pass the flame down over the metal already deposited so that it will remain red hot and expand until the weld is finished. We next trim the weld and in doing this, we remove about 10 per cent of the reinforcement, and this insures every bit of metal in the weld being solid. You can very readily detect cold shuts in the weld when it is being trimmed. This is caused by insufficient workmen.

"We use about sixteen pounds of metal for this size frame and it requires about two hours to complete the weld and never costs over $22.00. This method is 100 per cent.

"I thank you for being so kind as to listen to me and for not getting offended. I again assure you I meant nothing personal. I sure was glad that no one was offended and enjoyed myself so much that I just had to pass this along to the boys on the firing line as I am sure someone will get as much benefit out of it as I did. Of course, I expect this will be criticized but we will accept criticism without comment."

CHICAGO OXYGEN MAKERS START SUMMER GOLF SERIES

The first of a series of summer golf outings was staged at the Green Valley Country Club, Wheaton, Ill., on Tuesday afternoon, June 30, by members and associate members of the Gas Products Association. Those present were M. L. Goodrich, Swift & Co.; C. T. Allen, Secretary of the Association; M. H. Fairchild, M. H. Fairchald Soap Company; W. H. Stone, Champion Chemical Co.; C. W. Brown, Innes-Spieden Co.; J. B. Coambs, Smith, Lawson & Coambs; E. N. Krein, Bastian-Blessing Co.; E. A. Faulhaber, Burdett Oxygen Co.; M. Keith Dunham; H. B. Pearson, Burdett Oxygen Co.; H. S. Card, The Welding Engineer Publishing Co. Following eighteen holes of golf a fine dinner was served at the clubhouse. It is planned to have several more of these half-day outings before the golf season closes.

SALVAGING OUT WEST

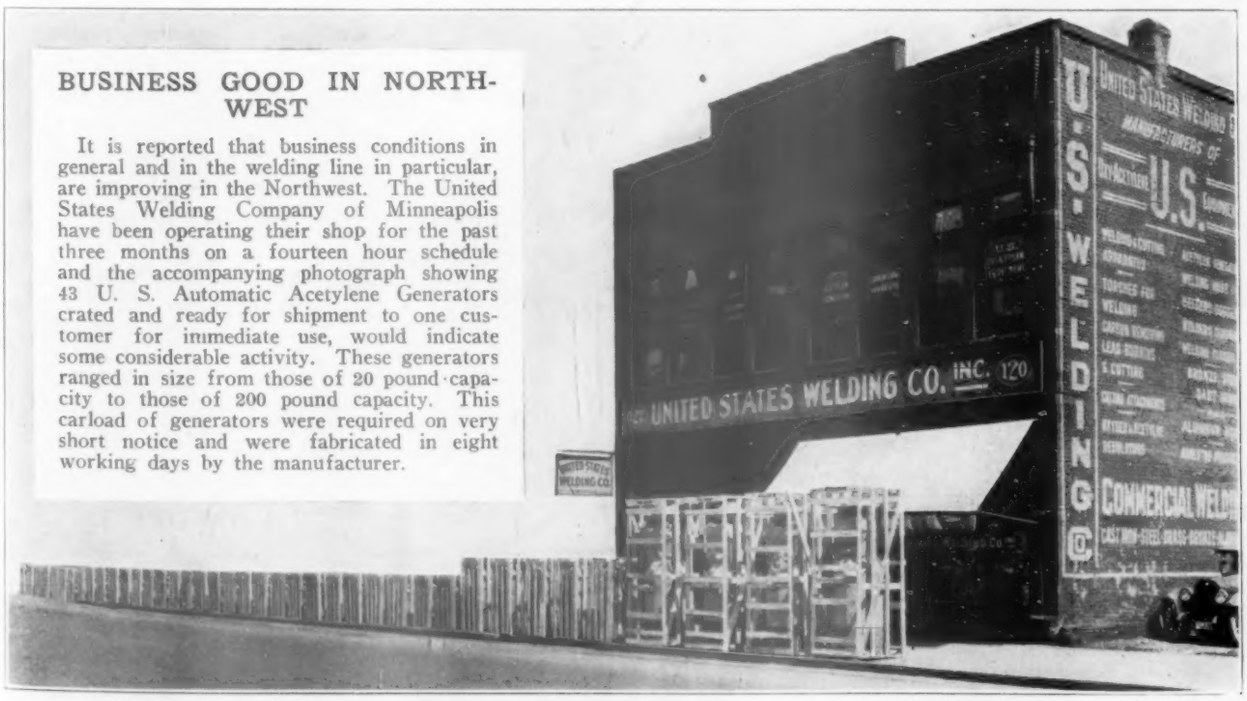
Variety is not only the spice of life but the spice of ingenuity in the life of the cutters at the Western Salvage Company of Los Angeles, Calif. Locomotives, Corliss engines,

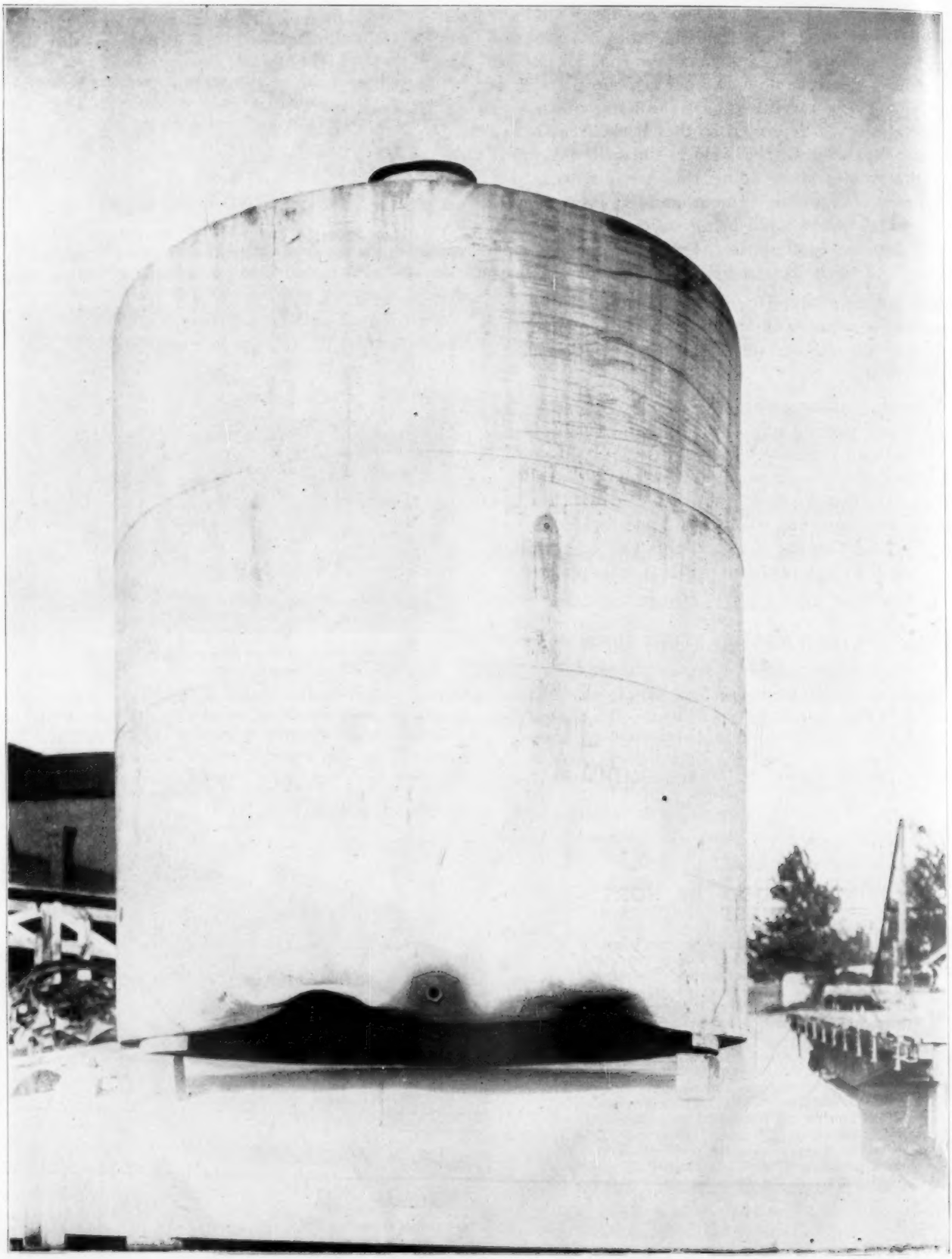
The Torch at Work on a Locomotive Wheel.

armour plate, propellor shafts—pretty nearly everything under the sun that is made of metal comes to them in the form of scrap to be cut up for industrial use. This photograph, forwarded by the Purox Company, shows an operator on the job in the yards of the Salvage company.

BUSINESS GOOD IN NORTHWEST

It is reported that business conditions in general and in the welding line in particular, are improving in the Northwest. The United States Welding Company of Minneapolis have been operating their shop for the past three months on a fourteen hour schedule and the accompanying photograph showing 43 U. S. Automatic Acetylene Generators crated and ready for shipment to one customer for immediate use, would indicate some considerable activity. These generators ranged in size from those of 20 pound capacity to those of 200 pound capacity. This carload of generators were required on very short notice and were fabricated in eight working days by the manufacturer.





Welded Seams Stood This Severe Abuse Without Leaking.

How Strong Is a Welded Tank?

One Welded Gasoline Storage Tank Took a Big Bump Which Bent the Welds But Could Not Break Them

HOW strong can we expect a welded tank to be, compared to a similar tank made with riveted seams? How long will it be until we can make tanks as strong as they need to be with welded seams? Questions of this nature are still being asked by those who have not been well informed on the progress of the welding industry. Doubters shake their heads at laboratory tests and recall early failures which they have not taken the trouble to analyze and which are not typical of the modern tank builder's experience with welding.

One afternoon early this month a great crowd collected to watch wrecking trains work on the removal of a huge locomotive which had turned over on its side opposite the passenger station in one of Chicago's large railroad yards. Yet the accident did not seem to have any effect on the desire of the homegoers to use that same railroad line to get home. Experience had taught that the danger of riding on the railroad is comparatively small. It is no secret that the welding processes are just as trustworthy as the railroads, that aeroplane construction, where hazard must be reduced to the smallest minimum, depends upon them for the rigidity and tenacity of countless forms of joints, but some people stick to the riveted seam and call it "playing safe." Many of them ought to shed some of their doubts after a study of the tank shown on the opposite page.

This is an unretouched photograph of an all welded tank, which was built over eight years ago by welders in the employ of the Boardman Tank Company of Oklahoma City—electric welded throughout. In 1916 this welded tank was sold to the Sloan-Forsberg Oil Company, who set it up on a seven-and-a-half-foot staging and put it into use for gasoline storage. After it had been in use for four years, without showing any defect in construction, the staging collapsed one day just after the tank had been filled with gasoline. When the tank crashed to the ground it fell across two stringers which were lying edgeways, crushing the bottom in as shown in the photograph.

This is a kind of service test to which few welded structures are submitted, and since the tank was not intended to undergo such treatment it would not have been disappointing to find that it had given way. But after a careful examination it was found that not a single leak had developed. So they hoisted it up on a new staging and proceeded to use it for another period of four years, during which time no leaks were noticed.

Came a time when the Sloan-Fosberg decided to move to another location, and wanted to continue using the storage tank which had given such unusual service. The appearance of the dented tank was not satisfactory, however, so they called upon the Boardman Tank Company to straighten it. After all this abuse and eight years of service they still considered it worth straightening. The job was finished to the entire satisfaction of the owners, and the tank is apparently good for an indefinite period of service. Mr. Whitlock, general foreman of the Boardman plant, declares that no riveted tank could go through a test of this character without springing a leak.

Good welding equipment and good materials are not hard to find, for with the perfection of the welding procsses has come the development of several standard lines of dependable merchandise for welders, and the training of service men to assist in the intelligent selection of materials and methods. Good welders are said to be scarce, but eight years ago there were men available for the best kind of welding, as this story shows, and the times haven't changed in this respect. The labor problem in welding today is due to shortsighted attempts to get good welders through indifferent training of carelessly selected workmen. A good intelligent workman, properly trained, will develop into a skillful welder without much trouble if the boss makes it worth his while. Any firm can get from its welding department results on a par with those described above if a reasonable effort is made to provide good labor as well as good materials. It is not true, as some engineers think, that only a lucky few are able to substitute welding for riveting and get complete satisfaction.

The story is not published as an example of extraordinary welding results. On the contrary, this particular job is so commonplace that mention of it comes as a result of wholly unexpected service. It is excellent welding, to be sure, and reflects credit on the Boardman organization for the high standard of their workmanship. The point is that these standards are not out of reach of any organization engaged in the fabrication of metals, provided they are willing to be as conscientious in the application of whatever welding process they elect to use in their production program.

Here is a recipe for "Welding Satisfaction," taken from a sales engineer's notebook:—"Forget about price; specify metals for welding that have proven to be of good welding quality; design your joints for welding; use good standard welding apparatus of the proper capacity for the job you have, regardless of bargains available in used equipment; get filler rod from a reliable house which will supply uniform material best suited for the parent metal; pick intelligent mechanics to do your welding and give them a chance to learn the work; see that your supervisor or foreman understands the principles of welding and knows how to check the welders from every angle; insist on good work and pay for it at a rate that will keep down your labor turnover—then

you can charge for your product on a basis that means profit, sell it with a quality argument, and have nothing but satisfied customers."

This is probably the advice Mr. Whitlock would give to anyone who asked him how to build welded tanks as good as the one described. It is advice that seems unnecessary to a good many readers of *The Welding Engineer*, who have learned these principles by long experience. But it is advice which everyone interested in the advancement of the welding industry must continue to broadcast so long as there remain signs of ignorance of the real possibilities and the real dependability of welding.

COMMERCIAL DEVELOPMENT CONFERENCE AT MACKINAC

Gas Products Association Convention Gives Attention to Methods of Promoting the Growth of the Gas Welding Industry

Reservations made early this month for the summer meeting of the Gas Products Association, which is being held at Mackinac Island, July 20 to 25, include a number of members and guests who have not been able to attend in previous years, and who come prepared to contribute new ideas and experience to the success of the meeting. This group, composed of oxygen, hydrogen and acetylene gas manufacturers, and welding apparatus manufacturers, will devote the main part of the program to the discussion of problems common to the industry, and to a study of ways and means by which the industry can be further extended.

Arrangement of the formal program was not complete at the time of going to press with this issue of *The Welding Engineer*, but a short outline of some of the papers in preparation will indicate the amount of interest which will be attached to them. R. K. Randall, director, Welding School, Cleveland Y. M. C. A., will speak on the subject of training operators. The separate problems of training welders in schools and training them in various types of plants will be considered in two separate papers. There are a number of things which every plant operator should know about gas pressure gauges, and these things will be explained in detail by Joseph Halla, of the National Gauge and Equipment Co. It is expected that Dr. Paul Heylandt of Germany will be able to contribute some information on the development of welding in Germany, but this is not definitely promised. England, however, will be represented without doubt by O. Simonis, managing director, Liquid Air, Ltd., London, who is prepared to talk about the oxygen industry in the British Isles. C. T. Price, formerly Secretary of the Association, and now connected with the Portland Oxygen Company, is down on the program for a talk on market analyses. J. J. Flaherty, Page Steel & Wire Company, is expected to tell the members what the sales force should know about welding wire.

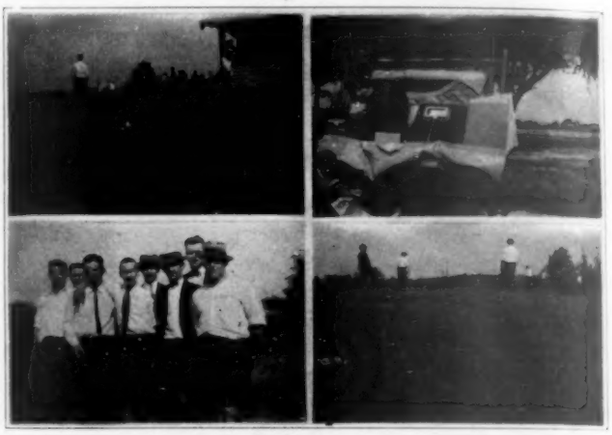
There are several other interesting talks which may be available, and with the committee reports will round out a very worthwhile program. It is also planned to hold symposium discussion of such subjects as plant operation, getting new customers, promoting the exchange of ideas in the organization, promoting the extension of welding in special fields, etc.

It is the desire of the executive committee to make the meeting constructive and worth while, but between sessions there is opportunity at Mackinac for a great variety of sport and recreation, consequently all those who are attending expect that it will be a real pleasure trip, and are not apt to be disappointed. A golf tournament for the golfers, special entertainment for the ladies, a good pool for the swimmers, courts for the tennis fans, horses for the good riders, and a pleasant boat trip up the length of Lake Michigan and back for everybody, are just a part of the "fun" that's to be had.

CLEVELAND WELDERS STAGE PICNIC

The first annual picnic of the American Welding Society, Cleveland Section, was held Saturday afternoon, June 20th, and was attended by over a hundred local welding celebrities. The party left Public Square in autos attractively decorated, and carrying large banners telling who they were. Upon arriving at the picnic grounds, all guests were registered and given numbered cards and later on there was a bit of excitement provide in a prize drawing event.

After registering, the party was escorted to the "bar," where a large quantity of a liquid labeled "Oxygen" was sampled, and immediately consumed. The reserve provision for parched throats consisted of twelve cases of P. O. C. beer donated by the Welders Supply and Manufacturing Company.



The A. W. S. Picnic at Cleveland

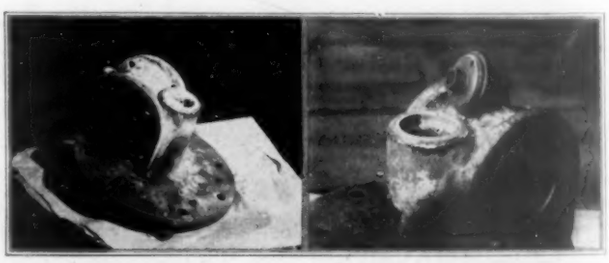
A baseball game between the acetylene and electric welders was won by the torch artists, and was followed by a series of races and other athletic events. Then the winners and losers forgot their differences in a discussion of the generous lunch which was served under a grape arbor.

Prizes for the various contests were donated by the Cleveland School of Technology, the Welding Engineer Publishing Company, The Lincoln Electric Company, The Purox Company, The Ohio Chemical Company, Buckeye Welding and Supply Company, Aluminum Fix Company, Burdett Oxygen Company and the Betz-Pierce Company. They consisted of torch lighters, copies of The Welding Encyclopedia, welding goggles, electric welding helmets, hand shields, and a cutting or welding torch.

NEAT WORK ON AIR PUMP TOP HEADS

By F. W. B.

The two photographs illustrate a very practical method of re-threading the reversing valve cap portion of the top head of 9½-inch Westinghouse air pumps.



Built-Up Head. **Tapped and Ready for Service.**

The extent of the thread is limited, due to the necessary construction of the parts and a too energetic use of the wrench in removing or applying the cap occasionally ruptures the thread.

Below the threaded portion in the head is of course the cavity for the reversing valve bushing, and to it is centered the head in the machine for turning out the old threads prior to loading, and also to rethread for the new cap.

Cut No. 1 shows a loaded head. No. 2 after it has been rethreaded and ready for fitting and driving in the bushing.

The writer has seen this method successfully used for some time, it being but another of the many ways in which the torch and rod saves labor and expense.

Reclaiming Locomotive Main Rods

Rods Weakened By Repeated Reaming Operations Are Restored to Original Strength by Thermit Welding

By Joseph Murphy*

IN the rear end of locomotive main rods there is attached a steel strap which holds the bronze crank pin bearing. This strap is fastened by means of three or more taper bolts and due to the excessive strain exerted by large cylinder locomotives and modern power, it is difficult to hold this strap securely. In time, due to repeated reaming at each shopping, the holes become so large that both rod and strap are weakened to such an extent that they cannot safely be continued in service.

About three years ago I conceived the idea of filling these holes with thermit steel and reclaiming the rod, a process which has worked out very satisfactorily and profitably. The process is quite simple and a description follows.

Fig. 1—Rear End of Rod Arranged for Three Taper Bolts.

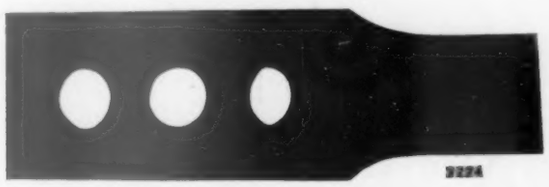


Fig. 2—Showing Three Taper Holes, Thoroughly Cleaned in Preparation for Thermit Repair.

A sheet steel box is constructed of 3/16-in. boiler plate, of proper size and so located that when it is set on the stub end of the rod there will be a clearance of from 2 to 3 in. between the rod and bottom and sides of the box to allow for ramming the sand about the rod. This box serves to hold the mold which is built around the rod.

The stub end of the rod illustrated in Figs. 1 and 2 is thoroughly cleaned and three wooden plugs driven into the holes at the small end of the taper. The plugs are waxed over as shown in Fig. 3 and the rod so placed that the plugs are on the bottom. The box is then placed on the rod and the sand rammed at the bottom and sides to the top of the rod. A wooden plug is then placed over the holes, the base of this plug being sufficiently wide to project about ¼-in. beyond each side of the holes. This is illustrated in Fig. 4. The sand is then rammed about this block, and the edge of the mold dished to prevent the metal and slag from overflowing the box. The block is then removed, forming a riser for the metal. The end of the rod, together with the box and mold, is now inserted into an oil furnace and heated for about two hours until the temperature is brought to about 1550 degrees Fahrenheit.

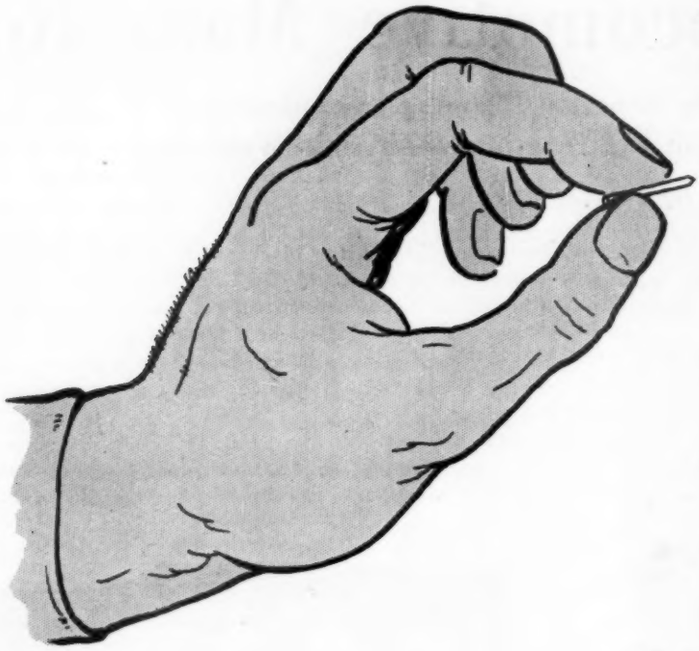
While the rod is being heated the welder prepares his crucible. About 40 lb. of Railroad Thermit, when filling three holes, is charged into the crucible, the ignition powder placed on top and the cover applied, after which the crucible is suspended from a jib crane to allow for adjustment. The rod is then removed from the furnace, leveled and all particles of sand and scale blown out of the holes. The crucible is then so adjusted that the tap is directly over the riser and sufficiently high to enable it to be swung over, if necessary, after tapping the mold. The reaction is started and 25 to 30 seconds later the crucible is tapped. As the Thermit metal fills the holes the plugs which have been burned during the preheating rise to the top, allowing the metal to flow into the impression made by them at the bottom of the mold. The weld is allowed to cool for about four hours, then stripped as shown in Fig. 6, and the machining of the rod carried on in the usual manner. This finished job is shown in Fig. 7.

Fig. 3—Wax Matrix Which Covers Taper Ends of Bolt Holes, Before Constructing Mold.

The total cost of the operation, including labor, cost of material and subsequent machining has averaged $24.54 per rod as compared with the cost of a new rod of approximately $136—an average saving of $111.46 per rod.

Many rods are now in service after having been reclaimed

*Shop Supt., Boston & Albany R. R., West Springfield, Mass.



This little pi
REGO R

YOU have seen folks use a silver spoon to keep a glass from breaking when pouring boiling water into it. The spoon radiates the excessive heat away from the glass and prevents cracking.

Rego Regulators are protected in much the same way. When the oxygen tank is opened quickly by the operator, excessive heat is produced in the nozzle. A little brass pin radiates this heat back into the inlet arm and absolutely prevents burning-out the Regulator seat.

The gas in the oxygen tank is under heavy pressure—when the valve is opened with a quick jerk, the gas rushes into the nozzle of the regulator. This rushing gas is suddenly stopped by the seat. And, what is more—is compressed in the inlet just back of the nozzle. Terrific heat is generated by this quick compression. A temperature of 600 to 700° F exists for a moment at the center of the nozzle.

Now—when the seat is worn and flaky, the high heat, being concentrated on the seat, easily ignites it, and, because pure oxygen is present, the seat burns out with a sudden flash. However, that little brass pin in the nozzle of the Rego Regulator removes all danger. It radiates the heat back into the inlet arm and positively prevents any combustion of the seat.

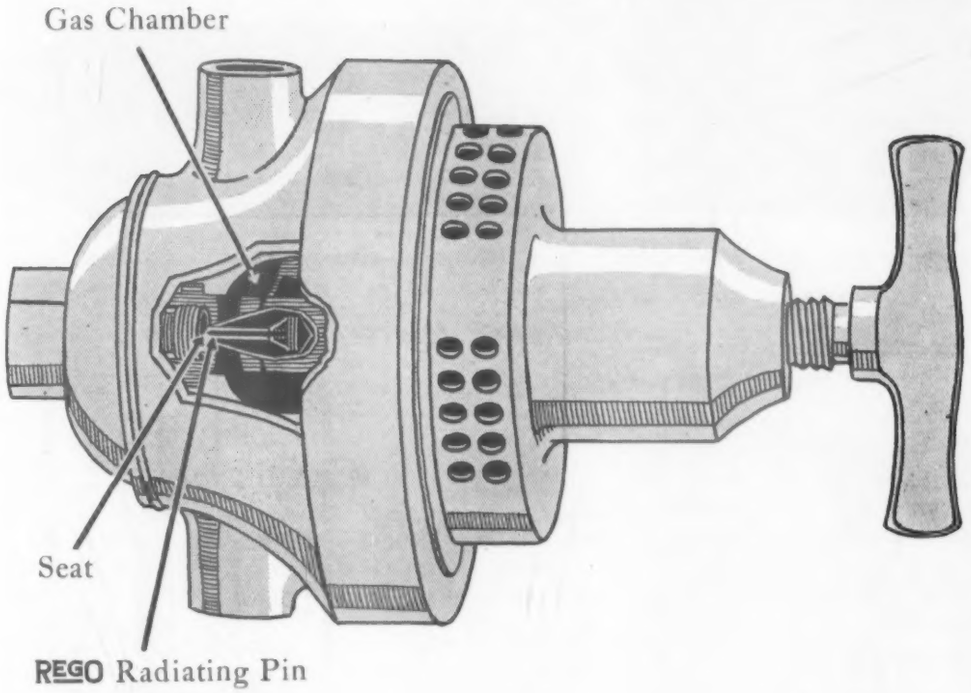
This is just one of the many improved features of Rego equipment—one of the reasons a careful buyer insists on Rego.

If you want welding and cutting equipment that will do better work, cause less trouble, need fewer repairs and use less gas—buy Rego.

The Bastian-Bl

246 E. Ontario Street

pin helps make Regulators fool proof!



REGO SALES SERVICE REPRESENTATIVES

Syracuse, N. Y.	National Welding Equipment Co.	517 E. Water St.
Louisville, Ky.	Kentucky Oxygen-Hydrogen Company	Logan St. and Goss Ave.
New York, N. Y.	Weldox Equipment Co.	359 W. 52nd St.
Dallas, Texas	Southwest Welding Supply Co.	209 S. Pearl St.
Kansas City, Mo.	Western Welding Equipment Company	308 E. 17th St.
St. Paul, Minn.	St. Paul Welding & Manufacturing Co.	174 W. Third St.
Los Angeles, Calif.	A. W. Courtney	441 Douglas Bldg.
San Francisco, Calif.	Stuart Oxygen Company	215 Bay St.
Seattle, Wash.	A. C. Eck Company	914 First Ave. S.
Butte, Montana	Mountaineers Welders Supply Co.	
Seattle, Wash.	Ferrofix Brazing Co.	816 First Ave. S.
Toronto, Canada	Carter Welding Co. of Toronto, Ltd.	165 Adelaide St. W.
Portland, Ore.	Welder's Equipment & Supply Co.	91 North Second St.

ssing Company

Chicago, Ill.

by the method just described and these are practically as good as new. We have found that after the above operation, when the new bolt holes are drilled to the original size, we can secure a full term of service from the rod. A diagrammatic sketch of the rod in the mold box is shown in Fig. 5, this

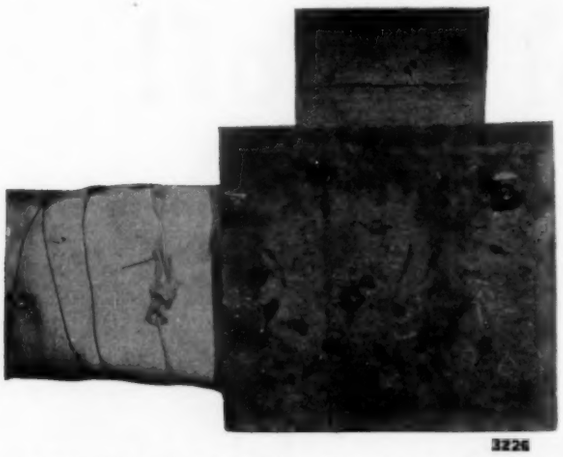


Fig. 4—End of Main Rod Enclosed in Mold, Showing Wooden Plug.

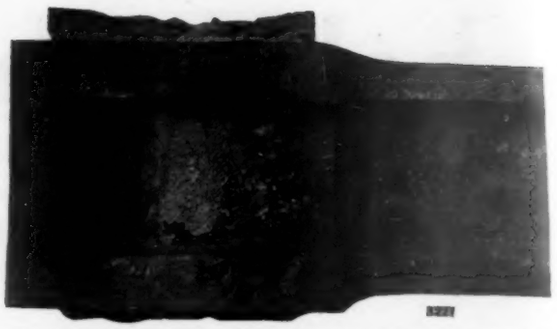


Fig. 6—Finished Weld, After Stripping, Before Machining.

Fig. 7—The Finished Job. Good as a New Rod.

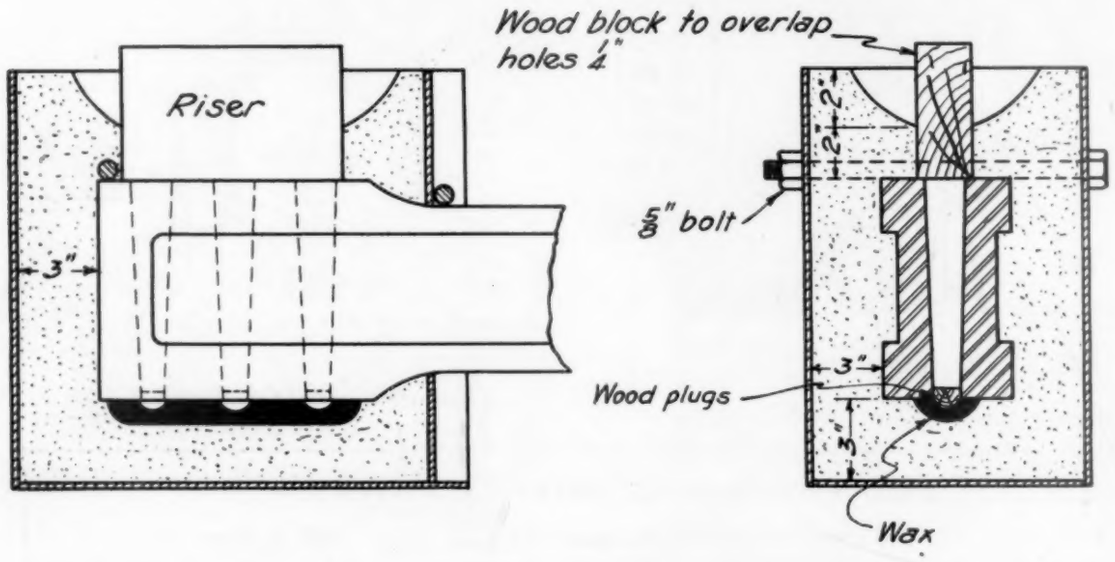


Fig. 5—Mold Box, Showing Position of Main Rod, Wax, and Wooden Plugs. Bolts Hold Steel Box in Position During Ramming.

sketch giving possibly a clearer insight into the actual operation than the photographs of the weld.

Editor's Note:

It will undoubtedly be of interest to our readers to know that this particular kind of repair is permissible according to Rule 128-A of the "Interpretations, Rulings and Explanations of the Interstate Commerce Commission, Bureau of Locomotive Inspections." We believe that the only suggestion that can be made in connection with Mr. Murphy's method is that the wooden plugs placed at the taper end of the holes be omitted, as thier function can be fully filled by the wax plugging which is completely melted out during the preheating. There may be a possibility of charred material from the plugs being trapped in the steel.—*Reactions.*

TRUCK DRIVERS NOTIFIED TO HANDLE CYLINDERS CAREFULLY

In cooperation with the Bureau of Explosives, the Gas Products Association has prepared a set of suggestions to truck drivers for handling oxygen cylinders. Attention has been called to the careless manner in which some truck drivers in the employ of general trucking companies handle these cylinders and to their influence on the handling of the cylinders by employes of the railroads and express companies. The bulletin which has been prepared cautions drivers against dropping or bumping cylinders, allowing them to stand in the sun or near heating pipes, transporting without being properly braced, allowing them to come in contact with oil containers or oil soaked materials, rolling, handling with a sling or crane. Such precautions are necessary not only for safety but also for keeping cylinders and valves in good condition.

NOT EASY PICKING BY ANY MEANS

"Come on over and bring your cuttin' torch," was the invitation sent over the phone to Fred Stutz the other day. Fred is one of the mainstays of the welding force of the Imperial Brass Manufacturing Company, of Chicago, and he always seems to get the hard jobs. Often a customer buys a cutting and welding outfit and then without properly mastering the equipment goes out and starts a difficult job that would make many an old timer scratch his head. The result is a botched start that has to be corrected by the man who knows. It all looks so easy when the demonstrator or regular operator shows the buyer how to operate the torch and he gets the idea that any "sap" can do the work.

This was just the case the other day. A new hand started to cut a job that caused our friend Fred no end of worry when he arrived on the scene. Here's the situation or stage setting. Better use the last phrase for the work was done over at the Garrick Theatre, Chicago. In order to make the theatre more comfortable for the summer season the management bought a ventilating system and were planning to install it in the stack. The new man impressed the new outfit into service and thought that he would be able to cut the cast iron like the grocer cuts a piece of cheese.

Of course this was not possible for the stack was not so soft. It was 160 feet tall and 6 feet in diameter. The base of the stack was made of cast iron two and one-half inches thick. The hole was to be cut in this base about ten feet up the stack and the dimensions of the hole were to be 13 inches wide by 25 inches long. Add to these conditions a gale blowing up the stack so fast that one couldn't keep his hat on and you will get a slight idea of the situation. On top of this the work was so located that it was not possible to sit down or stand up, Fred had to sort of drape himself head downward and then let her have it until the heat almost overcame him, then he would come up for air and go back at her again. A brick wall ran around the stack at a distance of about 12 inches from it so you can see for yourself that the place was no municipal playground.

When Fred took over the work the new operator had managed to make a dent of about three-quarters of an inch in the cast iron. In doing this great amount of work he had also made the hole ragged on the top edge. That is, the hole was not ragged but the piece that was cut out had a ragged edge. The rest of the work where Fred took hold was exceedingly smooth considering the adverse conditions under which he was working. It was almost impossible to use much torch manipulation in his cramped position, and on top of that, as soon as he pierced the stack the aforementioned draft cooled the work almost as fast as he could heat it. This lengthened the time of cutting considerably and also added to the amount of oxygen consumed.

Finally the hole was cut to the size indicated by the chalk marks and Fred heaved a sigh of relief. However, his curiosity got the better of him and he decided to stick around and watch them put the ventilator in the hole he had cut. That was his fatal error and the old saying that "curiosity killed a cat" almost held true. In making the measurement they had taken the width of the ventilator and stretched a string the same length around the outside diameter of the stack. This of course gave them a hole which was not as wide as the ventilator due to the large size of the stack and its thickness. Before Fred could make a getaway he was again impressed into service and had to cut the hole out wider. This part of the job was even worse than the first part because the hole was there and the draft was greater and all sorts of dirt and dust kept constantly rushing up the stack. Fred isn't easily discouraged and so he got right to work and showed them how the cutting torch operates when in the hands of its master. He talked to the torch and the torch talked to the stack and in jig time the hole was the proper size. All in all it only took two and one -half hours actual cutting time and the oxygen consumption amounted to some 2,000 feet. It is a piece of work that Fred or any other operator can well be proud of and it is a job which certainly proves the worth of cutting apparatus in all difficult places. In fact, without the cutting torch it would be impossible to accomplish many feats of modern construction which through its use seem simple. This particular job also proves that the success of many jobs depends upon the operator; it was a hard job under adverse conditions, but the proper knowledge of the principles of cast iron cutting together with practical experience turned a failure into a decided success.

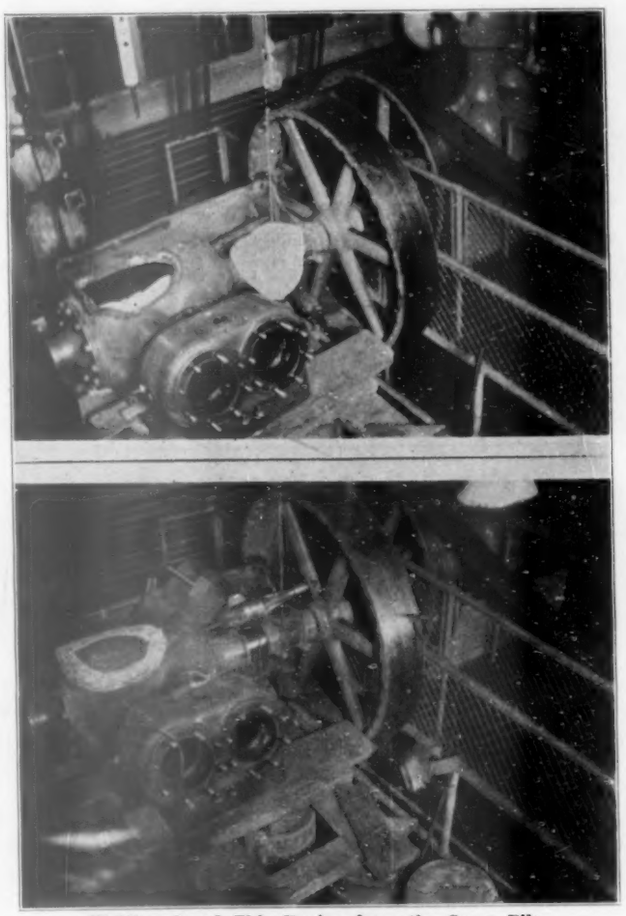
NEW EQUIPMENT DEALER IN SYRACUSE

The General Welding Works, 527 South Clinton Street, Syracuse, New York, has just been purchased by William McCarthy. According to a recent announcement Mr. McCarthy is going to handle a complete line of equipment and supplies for the trade in that territory.

Western Welding and Equipment Company under the ownership of Mr. Joseph Jardine has moved to 1040 West Lake Street, Chicago, Illinois. The new location is right next door to the former address and work is going forward the same as always.

A GOOD JOB FOR THE MONEL ELECTRODE

A rather fussy cast iron job was recently completed to the satisfaction of all concerned through the use of the monel metal electrode. The cylinder shown in the top picture had a large piece broken out, and to weld it of course meant leaving a bottom surface soft enough to work down smoothly. The Purox Company's Cleveland branch advised using a monel metal electrode for the bottom layer, the reverse of a common procedure of using monel metal for the top layer where a machinable surface is required. Their recommendation was followed with complete success, and the finished job is shown in the lower photograph.



Welding Saved This Engine from the Scrap Pile.

The Welding Engineer

Founded by L. B. Mackenzie, 1916

Reg. U. S. Pat. Office.

Published on the 17th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephones Wabash 7134 and 7140

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Telephone, Columbus 6941

Subscription payable in advance and postage free.
United States and possessions and Canada.....$3 a year
Foreign Countries.....$4 a year
Single copy, domestic.....25 cents
Single copy, foreign.....30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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VOLUME 10 JULY, 1925 NUMBER 7

CONTENTS

Welding the Ornamental Iron Product.....17
Arc Welding in Ship Building.....19
Welders—and Proud of It.....22
Gas Welding Locomotive Frames.....24
How Strong Is A Welded Tank.....27
Commercial Development Conference at Mackinac.....28
Reclaiming Locomotive Main Rods.....29
Not Easy Picking By Any Means.....33
Editorials.....34
Gas Welding Monel Kettles.....36
Arc Welded Steel Motors.....40
Production Welding for Small Shops.....45
News of the Welding Trade.....46
Current Welding Literature.....48

Selling the Welding Idea

APPARATUS and supply dealers who wait for their customers to come in and order everything they need are bound to pass up a large and profitable portion of the possible volume of business in the territory, for selling this line is essentially an outside job when thoroughly done. The occasional user who knows enough about welding and its possibilities to select his own materials without suggestion does not go shopping for them. He is too busy receiving callers who know what he is buying. Auto supply dealers, hardware, machinery, and implement dealers, who do a thriving business in welding apparatus generally depend upon a specialty man to concentrate on this department and keep the stock moving, and because they do this they get the trade. The dealer who gives only casual attention to welding and is satisfied to "fill orders" for welding outfits would probably be surprised to learn how good a volume can be built up in supplies and accessories, by following up these customers for their requirements in the way of gases, fluxes, rods, goggles, preheating burners, grinders, and the other items that are useful wherever welding is done. The only obstacle to a good many of them is a profound ignorance of the trade itself. It is necessary to keep informed of the improvements that are constantly being made in procedure, of the new applications that are being found, of the successes that are being discovered, and of the genuine utility of welding in every kind of plant. Competition is keen enough so that the active demand is fairly well met. More business means making a bigger demand, and it's necessary first to sell the welding idea to pave the way for an increased demand for the materials.

Service Comes First in Development

THE summer meeting of the Gas Products Association recalls the fact that America is noted for its associations and their conventions. Our bent for organization in time of peace enabled us to accomplish a series of miracles in time of war in spite of our unpreparedness. However, in time of peace we do not organize for destruction. We organize for service. The keynote of practically all these group meetings is an attempt to unite a number of individual ideas looking toward the improvement and extension of an industrial service, for the benefit of a larger list of customers, into an organized plan of development. The motto is, "If we can give a greater service, we can expect a wider patronage." Few industries can compete with welding in rapid development, and in the broadening of its service, which goes hand in hand with development.

Drawings of Welded Parts

DRAWINGS of machines, boilers, tanks and apparatus assembled with screws, bolts and rivets, show every screw, bolt and rivet, and specify the size, location and spacing of bolt and rivet holes.

Drawings of welded parts usually specify "weld" only, or perhaps "arc weld," or, "gas weld," leaving to the supervisor or welder how the weld shall be made, how the parts shall be prepared, how the parts shall be tacked, amount of reinforcement, if any, etc.

Without arguing the question of whether it is feasible to detail all this information or whether the draftsman is competent to furnish it, the fact remains that a wide gulf exists between the information furnished the shop in the first case and that supplied for the welding job.

What would be thought of the ability of a machine designer who left all details of screws, bolts and rivets to the "judgment" of the shop men? On the other hand, what would the average welder think of the draftsman who undertook to tell him how to make welds? But it can be done in a measure and it must be done to the practicable limit as welding is more and more employed for uniting components.

This brings to attention the need for signs and symbols—a short hand system that conveys to the shop men the information for intelligent and systematic welding procedure.

Economy and convenience in welding and cutting are obtained by using the oxygen for both operations with

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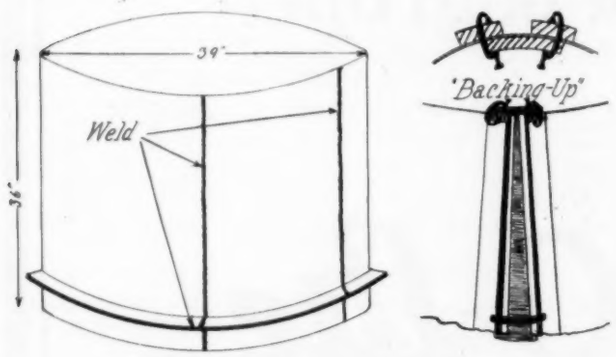
Gas Welding Monel Kettles

The Secret of Successful Welding on Thin Monel Metal Sheets Lies in Correct Preparation of Work

"MONEL metal welding is easy," says Robert Groen, and then spoils it by adding, "if you know how to prepare your work, and really see to it that the preparation is carried out as it should be." Mr. Groen is the manager in charge of welding in the Groen Manufacturing Company, Chicago. He is also in partnership with his brother, F. H. Groen. Together they conduct an oxygen plant business in addition to their very profitable welding plant.



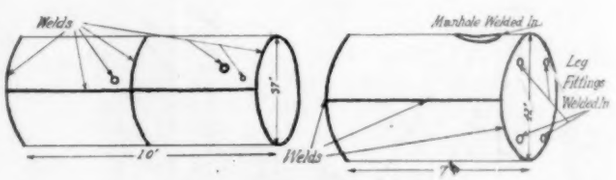
Method of Welding Monel Kettles.

"The trouble with most welders," continued Mr. Groen, "is that they do not take the necessary care in preparing their work prior to welding. No matter how good a welder a man may be he cannot get a good, strong weld in monel metal if he doesn't set the work up properly and use the necessary backing strips and clamps." Monel metal welding comes into use in the Groen plant in the manufacture of large kettles used in the preparation of oil for the varnish industry. The Groen brothers have turned out eight of these large kettles without a single failure. This is quite exceptional for the kettles receive hard usage and are also subjected to a temperature of from 600 to 700 degrees Fahrenheit.

The kettles are thirty-nine inches in diameter and thirty-six inches in height. They are circular in shape and have a flanged bottom and a welded cover. To give rigidity to the top of the kettle an iron band or ring is riveted to it with monel metal rivets. This ring is one-half inch by two inches and the ends are welded by the oxy-acetylene process, which process is used throughout the welding of these kettles. The kettle is made of sheet monel metal and there are two seams to be welded besides the bottom seam. The kettle is flanged around the bottom and the bottom also has a flange to it so the weld is executed on the edge of the flange. This seam is first tack welded every eight inches and then finished up in one continuous operation.

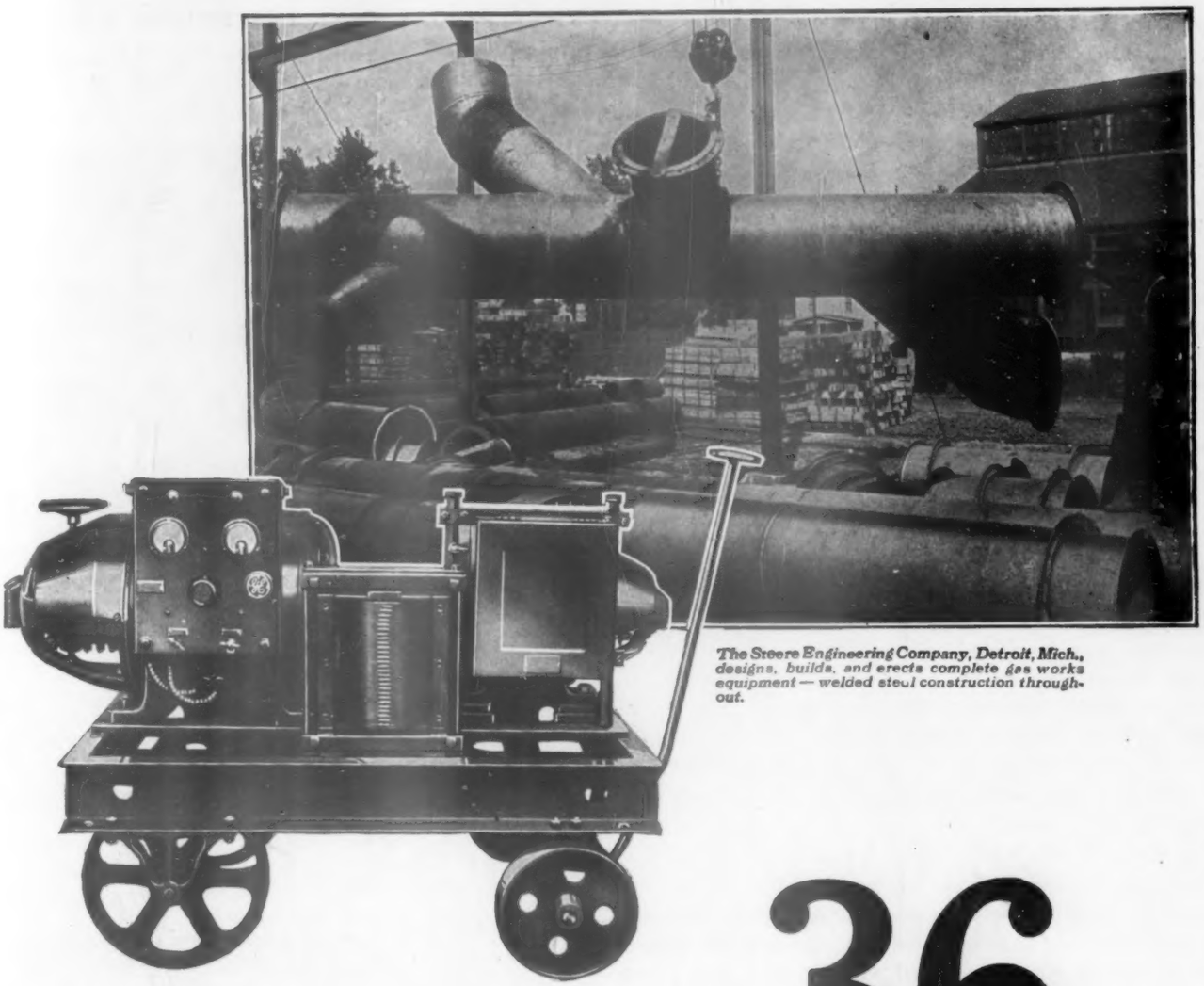
The most interesting as well as the most important part of the work is the method in which it is set up. The illustration shows the two edges of the monel metal sheet being brought together with a gap of about an eighth of an inch at the top and one inch at the bottom. Of course the edge must be clamped in this position and properly backed up so that the welding will be done without any distortion or warping. A piece of iron bar is clamped directly under the gap. It is seven-eighths of an inch thick by three inches wide and thirty-six inches long. On the outer side of the kettle on either side of the gap are clamped two pieces of iron of about the same dimensions as on the inside. They need not be as wide, however. It is very important that the metal lay tight to the iron. According to Mr. Groen this is the most important factor in the entire set-up for if the metal does not lay absolutely flush with the iron bars the weld will be distorted. As the welding proceeds from the top to the bottom the monel metal is drawn together so that the clamps do not have to be readjusted. If backing is not used the metal will not hold up; it will run right through as fast as it is heated. This is the thing which makes the amateur think monel metal welding is the hardest of them all.

Another very important factor in the successful welding of sheet monel metal is the proper manipulation of the torch. Of course the torch is moved in the same manner as for other sheet metal welding, but the important thing here is to remember to use the white part or the white cone of the flame. For the type of work described here a one-eighth inch monel metal filler rod is used. A good brazing flux is used to give a good, clean, bright weld and take care of the oxides which form during the welding process.



Details of Arc Welded Tanks.

It is also well to remember what the chemical composition of monel metal is for then it is easy to remember the kind of flame to use. Monel metal is an alloy of nickel, copper, iron and manganese; some other elements enter into it but these are the chief ones. The copper in the alloy is the determining factor in choice of flame for an excess of oxygen or a great excess of acetylene is injurious to copper alloys. It is therefore necessary to



The Steere Engineering Company, Detroit, Mich., designs, builds, and erects complete gas works equipment — welded steel construction throughout.

Steere has 36

Commenting on the service of G-E Arc Welders, Mr. Steere says, "With G-E Arc Welders we are able to cut construction costs and at the same time make better looking jobs. Welded joints are absolutely tight and last longer. The ease with which these G-E Welders could be moved about and their ready adaptability for various forms of service, also account for their favor in our organization."

Thirty-six G-E Arc Welders are fabricating such shapes as the one shown for the Steere Engineering Company. Only G-E Welders are used—the selection came after a thorough trial.

In this case arc welding makes a neater job through the elimination of joints and fittings, and a construction which is much more dependable. It is typical of the developments G-E Arc Welders make possible.

Wherever metals are to be joined, built up, or cut down, G-E Arc Welders will do the job most efficiently. For your convenience Arc Welding specialists are located in every G-E sales office.

10-13

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N.Y., SALES OFFICES IN ALL LARGE CITIES

use a neutral or slightly reducing flame, and the size of the flame depends upon the thickness of the metal to be welded. In general practice one is safe in using a tip size just about two sizes smaller than would be used for the same thickness of steel. Right here it is well to add that it is good practice to keep the flame spread over the weld so that as much air as possible is kept away from the weld.

Aside from the very excellent monel metal welding which the Groen's do they also do production welding on anything that is offered them. According to Mr. Groen, they will weld anything that can be welded and when they receive a special order it doesn't take them long to start it on its way to completion. Special jigs are soon designed and the quickest and most efficient way of doing the work is soon decided upon. In this connection it is well to describe the electric welding they do on under ground storage tanks. Two types of tanks were being fabricated during the inspection of the plant. The first job was on three-sixteenths gauge stock. The tank was ten feet long and thirty-seven inches in diameter. The sketch shows how the tank was fabricated in two sections each five feet long. These were welded longitudinally and then the two sections welded together. The circular end seams were also electrically welded as were all of the fittings. These tanks were of 550 gallons capacity and when the welding was finished they were subjected to a ten pound hydraulic test. Mr. Groen said that it was very seldom indeed that any leak showed up in the weld and when it did it was an easy matter to weld the faulty place. Out of the hundreds of tanks which he has fabricated and which are in service not one has ever come back or given any trouble. About five to six hours actual welding time is required to finish one of these tanks.

Another style of tank which is turned out in great numbers has a welded manhole in addition to the other welding which is done upon it. This tank is not as large as the other, being only seven feet in length. However it is larger in diameter, being forty-two inches across. The top end of this tank is belled out and has all the fittings and holes welded in place. On the bottom there are other fittings and four threaded leg holes which are also welded on. The welded manhole is quite a feature of this tank as it does away with all of the bolts and rivets that are usually used. The flange is merely welded around the edge of the hole and the manhole set in the usual manner. This also does away with the saddle plate.

These two examples are only two of the classes of welding jobs which are turned out profitably by this company and merely go to show what can be done with the welding process. The plant is always full of work and the huge piles of finished work awaiting delivery show that they understand fully the principles underlying production work and speed. Speed is not their motto, though, for they insist that every product fabricated in their shops is tested and that only high quality work is done.

THEY REPORT THAT THE FISHING WAS GOOD

S. D. Winger, vice-president of the Gas Products Company, Columbus, Ohio, and L. F. Loutrel, vice-president of the Shawinigan Products Corporation, New York City, spent

Winger and Loutrel After Breakfast.

the week of May 28th chasing the elusive trout at Lake Wayagamac in the Province of Quebec. In the picture here, Winger is on the left and Loutrel is on the right, and they're both having a corking time.

A GOOD LOOKING TRUCK ADVERTISES THE SHOP

The Peerless Welding Company, St. Louis, is an up-and-coming, well equipped, live wire welding shop. Willis McCollum, the owner, believes in good welding backed up with

Good Delivery Service Promotes Business.

the right kind of delivery service. Up to date trucks give good service and have a tremendous amount of advertising value for welding shops. The photograph shows McCollum's truck and also a portion of the front of his shop.

Considerable attention is given to organized and systematic training of welders throughout France. In one of the colleges of industry and applied arts there is a regular course in oxy-acetylene welding which ordinarily takes care of a class of ten students. In addition to this there is in the same school an arrangement whereby workmen and apprentices can secure instruction on Saturdays. As many as twenty-three students have been enrolled at one time for this work. The Secretary of War has also made arrangements for the establishment of a welding course to serve the different branches of the army. The first course will be given at Nainterre and is reserved for noncommissioned officers in the artillery, three courses are reserved for the air service and will start in June.

Tobin Bronze Welding Rods, because of their uniform composition and dependable quality, are recognized as standard for butt-welding cast iron pipe.

Tobin Bronze welds 13-foot fracture in water main

These illustrations show how Tobin Bronze Welding Rods were used to seal a 13 foot fracture in a water main at Washington, D. C.

Tobin Bronze—an exclusive product of the American Brass Company—melts at 1625°F., flows freely at 1650°F. and makes joints 100% stronger than cast iron and equal in strength to steel welds.

The use of Tobin Bronze Welding Rods eliminates the expense of pre-heating the parts to be welded since it flows freely at a comparatively low temperature. The welds, which are strong and tough, can be made with considerable saving of time and money.

If your regular source of supply does not handle *Genuine* Tobin Bronze rods with the name stamped in the metal, let us tell you where they can be obtained.

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Canadian Mill: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

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WELDING RODS

Arc Welded Steel Motors

Steel Shapes Replace Iron Castings in Production of Lincoln Motors—Welding Makes This Possible

THROUGH the application of the arc welding process, the Lincoln Electric Company of Cleveland has been enabled to put out a new steel motor, the one of its kind on the market. The motor replaces the older type which employed cast iron or cast steel in its frame, primarily because it could be cast into the many and varied shapes involved in the structure of the motor.

The new motor is the outgrowth of many years of research and experimental work on the part of the firm's engineering force, and brings into use many factors which will probably have a revolutionary effect on older practices of the metal industries during the coming decade.

The successful application of arc welding in the construction of the Lincoln motor has made possible the replacement of castings, with rolled steel. This means a motor of greater strength and greater stiffness.

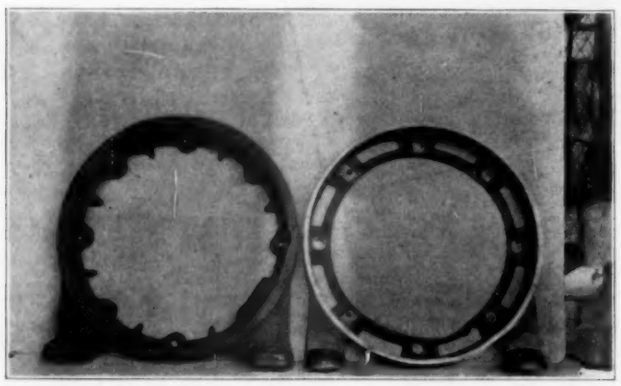


Fig. 1—Comparison of Cast Iron Ring (Left) and Welded Steel Ring (Right)

Back of the years of experimental work, which has been done, has been the guiding thought that if arc welding could be successfully applied to the construction of the metal parts which enter into the electric motor the firm would be able to supply users a motor of lighter weight, greater power, perfect ventilation and of an almost indestructible nature, at a cost no greater than that asked for the old style product, built of cast iron or cast steel.

When the relative costs of standard shapes of rolled steel are compared with those of other elements which might be used in motors, on the basis of present market prices, it becomes evident that through the use of the steel shapes the manufacturer so reduces his material costs as to be enabled to give the trade a greatly improved product at no increase in price.

Standard shapes of rolled steel have at the present time a cost of approximately 3 cents per pound; iron castings have a cost of from 4 cents to 20 cents per pound with an average of 6 cents; drop forgings range from 10 cents to 40 cents per pound, with an average of 15 cents; malleables have a cost of from 10 cents to 40 cents per pound, with an average of 15 cents; steel castings have a cost of from 8 cents to 20 cents per pound, with an average of 12 cents.

A comparison of the relative tensile strength of rolled steel as against that of other possible metals for use in electric motor frames, quickly demonstrates why it is that the new motor is much stronger than others of equal size, but built from cast materials. Rolled steel, it is pointed out, has a tensile strength of approximately 55,000 pounds per square inch; cast iron, 10,000 pounds per square inch; malleable, 30,000 pounds per square inch; steel castings around 50,000 pounds per square inch. Rolled steel, it will thus be seen, has five times the strength of cast iron, twice that of malleable and even slightly greater strength than steel castings. Because of the severe strain to which the strength of a motor may frequently be put it is of prime importance to produce one which will afford the greatest possible resistance.

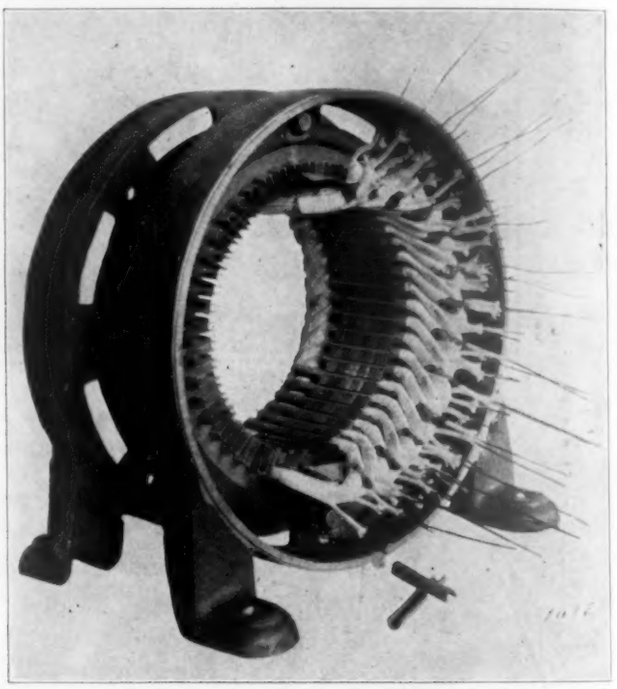


Fig. 2—Note Air Spaces. Also Welded Steel Feet.

The relative modulus of elasticity of different metals is another element which has been an important consideration and which has caused the company to do extensive work in developing its present rolled steel frame for the motor. Steel, it is said, has a modulus of elasticity half as great as cast iron, which means that if a shape is made both from cast iron

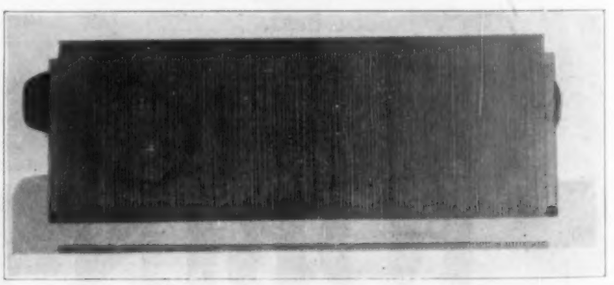


Fig. 3—Cross Section of Motor Laminations.

and from steel, that the shape will bend twice as much with the same load if made of cast iron as it will if made of steel. In other words, the steel frame has twice the stiffness as has one made of cast iron.

In their research work it was found that from the very nature of the case, castings cannot be made of the very best possible shape for use in a motor, for resisting either tensile or shearing stresses. They must be made in such shape which will permit of moulding and pattern drawing.

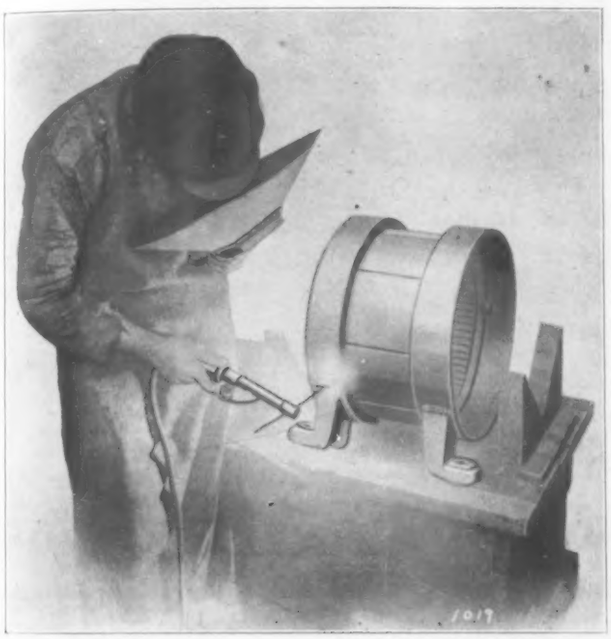


Fig. 4—Welding Steel Feet to Frame.

Steel, however, must be rolled from standard shapes such as channels, I-beams, angles and plates. The desire to apply rolled steel to such structures as that of a motor, it is said, has always been present because of the obvious advantages to be gained. But, this is as far as the matter went until the perfection of the welding process, because engineers had been

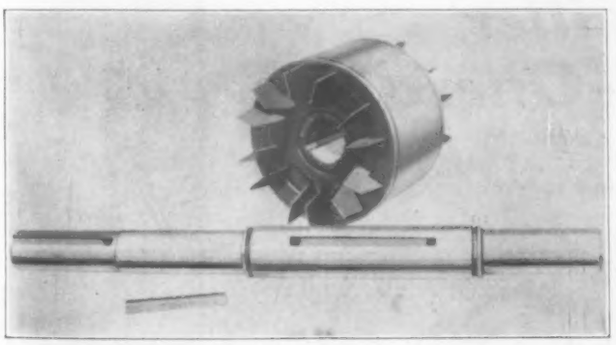


Fig. 5—Shaft and Arrangement of Vanes.

unable to use the steel as it would not adapt itself to intricate forms frequently required. So, until the advent of the Lincoln "Linc-Weld" motors, which have demonstrated the practicability of the use of rolled steel for the frames, cast iron found favor in spite of its many disadvantages. This was because it could be moulded into any form and would shape in a mould with great facility, because when melted it would run easily.

The welding process has entirely eliminated the difficulties which were present before, and has made possible the shaping of structural steel parts into any form needed and adapted them to practically any kind of machining. In some cases in the construction of the new motor the use of steel means rolling and welding; in others it means taking several pieces and welding them together, and in still others it means shaping, welding and then punching holes and other appurtenances in them, but in every case it has lent itself well to the particular requirements.

Before taking up the detailed process by which the parts are made it is well to keep in mind that the Cleveland firm for thirty years past has concentrated its attention on the one problem of manufacturing induction motors.

In manufacturing this motor, end rings, or the frame, are made from standard steel angle, instead of the usual cast iron. The angle is first rolled to circular shape on a machine especially designed by the firm's engineers, and then is welded making a union which is as strong as the original material itself.

The heating, shaping and welding of the end rings takes but a few minutes for the entire operation. First, the angle is heated, then attached to a specially constructed machine,

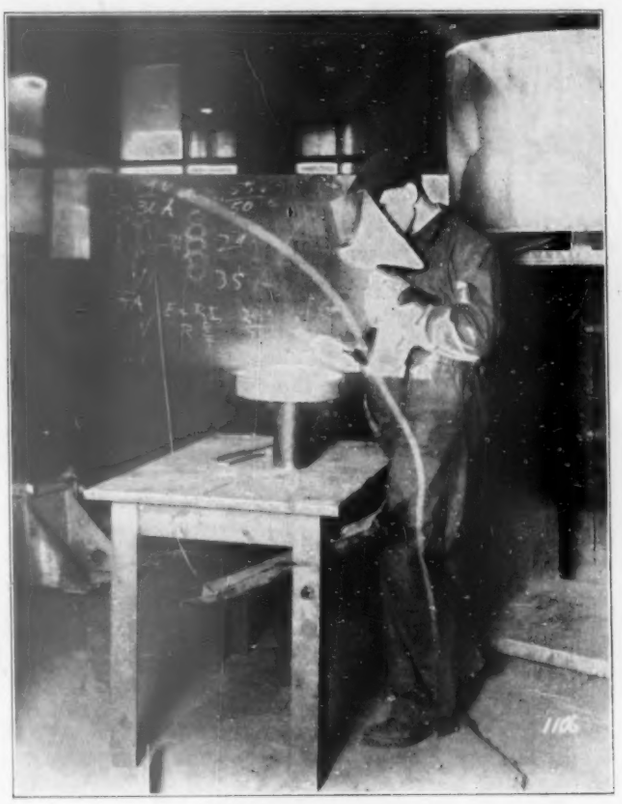


Fig. 6—Starting to Build a Motor.

which when in operation turns the steel to shape and makes it ready for the weld at the joint.

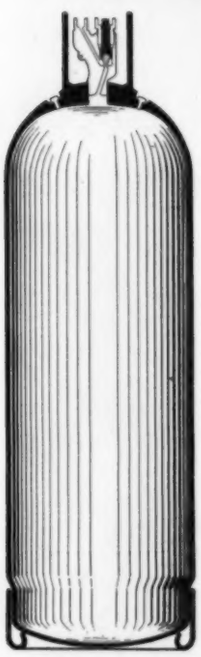
This type of end ring, as illustrated, has eliminated all breakage such as had been experienced in the past where cast iron was used. This applies both to the assembly process and to the ring in actual service.

Aside from the fact that the steel ring has been found to be much stronger it has been found that through its use it has been possible to introduce improvements in the design of the motor, as it offers less obstruction to the passage of air through the motor, than does a cast iron frame.

The fact that there is the least possible obstruction to air spaces is said to be one of the main contributing reasons for

OXECO ACETYLENE CYLINDERS

OXECO ACETYLENE CYLINDER FACTORY, MILWAUKEE, WIS.



The Cylinder Shell Absolutely Seamless

The OXECO cylinder shell is made entirely from one piece of carefully selected steel. Like an oxygen cylinder, it contains no seams or joints of any description.

Every step in the manufacturing process is under absolute control. Wall thickness and strength are accurately predetermined for every part of the cylinder shell. At no point is the strength of this shell an unknown quantity.

This truly seamless construction offers many advantages over a built-up or assembled shell.

The Porous Filler Monolithic-One Piece

OXECO mono (one) lithic (stony) filler is a single, hard, porous mass that completely fills the interior of an acetylene cylinder. The porous ingredients are bound solidly together by cement.

This stone-like filler cannot disintegrate in service. No sagging or settling can possibly occur, consequently a monolithic filled cylinder never can contain any voids or empty spaces, regardless of length of service or handling abuse.

These safety features make monolithic filled cylinders highly desirable from a user's standpoint. For the acetylene manufacturer, these cylinders have additional desirable features including low actual depreciation in service, low acetone release and high gas capacity without excessive tare weight.

Further particulars furnished upon request

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OXECO
—ACHIEVEMENTS—

54 Oxeco Oxygen Plant Installations

The total daily production capacity of OXECO plants in the United States amounts to *1,600,000 cubic feet or over 7,000 cylinders of oxygen per day.* Every OXECO installation is a real success. More OXECO plants have been installed than any other type of oxygen producing equipment.

99.7% Pure Oxygen

Oxygen users now demand 99.5% pure oxygen. OXECO plants have been developed to exceed this usual demand for high purity and in the case of many installations, *99.5% purity is the absolute minimum.*

Highest Plant Efficiency

How much does it cost to produce oxygen having a minimum purity of 99.5%? OXECO plants are now guaranteed to have *a minimum rate of conversion of 16%.* This means 16 cubic feet of oxygen with a minimum purity of 99.5% from every 100 cubic feet of air delivered by the compressor. This high efficiency slashes production costs from 30% to 50%

Service

Repair parts, if needed, are instantly available. OXECO plants are backed by a responsible organization that offers real service in connection with all matters pertaining to the oxy-acetylene industry.

Industrial Oxygen Plants

Large consumers of oxygen are rapidly taking advantage of the savings that can be effected by industrial oxygen plants. For more than a year OXECO industrial installations have been supplying oxygen through pipe lines to the Simmons Company, Kenosha, Wisconsin, and the Wheeling Steel Corporation, Portsmouth, Ohio. At the present time an OXECO plant is being erected to supply 99.5% pure oxygen to one of the largest railroad shops of a prominent eastern system.

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the new motor's ability to stand overloads. Figure 2 gives an idea of the air space permitting the greatest possible ventilation. It is pointed out that a cast iron frame would require at least 2½ times as great a cross section, as is required in the steel frame used for this motor, and thus would stand as a great obstruction to the free circulation of needed air.

In making the stator, thin sheets of steel or steel laminations, which make up the magnetic field are "stacked," and put under great pressure between two steel end rings. While they are compressed in this way they are hot riveted together. In this way the laminations are held firmly between the end rings. This application is only possible where steel is used in the end rings. The ordinary cast iron frame would break under the pressure used in drawing together the laminations. The steel frame not only permits of the use of great pressure without danger of breaking, but also allows for still greater contraction as the hot rivets cool. The steel laminations, it should also be remembered, are heat-treated to prevent any so-called iron losses . The importance of this feature, which insures against any possible loose laminations, will be recognized at once by those who have used the older type of equipment. Loose laminations not only cause noisy operations, but often cause chafing of coils and prevent the even density of the magnetic field.

Fig. 7—How Motors Are Carried Through the Plant.

In the construction of the rotor, steel has also been applied in order to get the best possible results. Here again the laminations are first assembled between two heavy steel end plates, and then placed under pressure and hot riveted.

The rotor has offered in the past one of the greatest problems to motor manufacturers. The difficulty has been to join the rods and end rings in the rotor so that the union would be perfect and the current would flow readily. Improper union between rods and end rings, it was found, was responsible in many cases for heating of the motor. Efforts have been made to overcome these difficulties in the rotor through the casting of the two parts in one solid piece, and brazing or soldering has also been resorted to, but no method brought about a satisfactory or perfect union until a perfect union of the rings and rotor rods was made possible by welding. Figure 3 shows a section of a rotor, illustrating the union.

End rings are made from strips of pure copper, bent into circular shape and welded, in much the same way as are the steel frames. The end rings are then punched and put over the drawn copper rods, which have already been inserted in the rotor, and which slightly protrude. At this point the entire rotor is placed in an especially designed automatic machine, where the rods and rings are welded solidly together. The result of this work is to bring the rods and end rings into one solid piece, and electrically to permit a perfect flow of electrical current.

The shafts are pressed into the rotors and keyed into place. This procedure is followed, so that in case a shaft becomes damaged it can be pressed out and a new one inserted without trouble.

Welding has also been applied in putting the heavy ventilating vanes on to the rotor place. Each vane is made a part of the plate itself, thus eliminating any possibility of the vane coming off and cutting windings, which would in turn destroy the usefulness of the motor. Shaft and vanes are shown in Figure 5.

Another important feature involves the application of welding. Instead of the feet of the motor being cast as part of a frame or being of light pressed steel, they are dropped forged steel, which are welded to the steel frame. The weld for the feet is shown in Figure 2 and the method in which they are put on the frame is shown in Figure 4.

A jig with perfectly planed surface is used for holding the feet and stator during the weld, so that the motor feet are always parallel to the shaft and will not rock when mounted on a true base. After the machine work on the frame is done, the feet are ground, making certain that they are not only parallel to the shaft, but are at right angles to the frame.

This is the first time that drop forged feet have been successfully applied to motor construction. Their great advantage lies in the fact that they do not break or bend and will stand all sorts of abuse.

Bearing shells for the motor are made of wrought steel, instead of the usual castings. It is said that while they are stronger yet they are thinner in sections, thus allowing for a greater amount of babbitt metal lining and for a larger shaft. The bearings in the end brackets are fitted into a seat at the end of the bracket, in such a way as to permit of no binding.

Even to one of the smallest parts of the motor, welding has been applied. The oil rings consist of two dished steel rings welded together. The deep grove thus formed in the center of the ring carries oil to the top of the shaft and bearing. Through the use of a baffle cup, the oil ring is prevented from riding or becoming stuck. The ring must turn as long as does the shaft. The oiling system is so thorough that, although they carry unusually large shafts, there is no danger of their wearing out.

The ventilating is said to be one of the most important features. In addition to the additional amount of air made possible through the use of the steel frames as against the much heavier and older style of cast frames, other features have been added to care for ample cooling. The welded steel vanes, referred to above, on the rotor, draw the air in at the end of the motor and throw it outward around the coils, and back through the slots in the steel frame, thus cooling every part of the stator. A steel deflector, welded to the inside of the end brackets, serves to deflect the air currents in the proper course throughout the motor.

Steel end bracket bolts are used to make a rigid frame for the shaft bearings. The bracket bolts extend through the entire motor. The conduit box on the motor is welded and made from heavy sheet steel.

In addition to giving a great deal of attention to the possible improvements of the motor through the use of steel and the application of welding, attention has also been given for the past 17 years to improving the windings of the motor. The motor is known very generally for its water-resisting powers.

Much of the hand work involved in the plant has to do with welding processes. Here attention has been given to the use of machines which would eliminate all possible unnecessary hand work. Figure 6 shows one of the plant's welders at work, on a motor.

Some idea of the manner in which the completed motors are handled by the packing department may be gained from Figure 7. They are carried along on a conveyor and simply picked off by the operator for crating.

The importance of the work carried on by the engineering force of the Lincoln Company, which has resulted in the perfection of this welded steel motor, is briefly summed up in the statement of Mr. J. F. Lincoln. "Through the use of 'Line-Weld' process it has been possible to increase the capacity of the motors 25 per cent at no additional cost," he says.

Mr. Lincoln forsees the day as not far distant when the application of the arc welder will have extended to such a place as to practically eliminate the need of patterns for making many manufactured articles and also in many cases eliminate the use of riveted sections, welding having taken their place.

CUTTING UP A STEEL AND REINFORCED CONCRETE BANK VAULT WITH AN OXY-ACETYLENE TORCH

It's a good thing Sam Sorrensen, of Oakland, Calif., is a welder and not a burglar by profession, for he is making short work of the cutting up of the big steel and reinforced concrete vault of the Central National Bank of Oakland and it illustrates what a powerful tool the oxy-acetylene torch can be in the hands of an efficient operator.

Cutting Against a Concrete Backing.

Mr. Sorrensen is using for this work a Purox Style "E" cutting torch and Purox oxygen, acetylene, apparatus and supplies. The material he is cutting on this job is ¾"x¾"x 1½" laminated steel which is backed up with reinforced concrete. To clear its way into the concrete a slight excess of pressure on a No. 3 Purox tip is required, 5 pounds acetylene and 40 pounds oxygen being the pressure he uses.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION AT CLEVELAND

The International Railroad Master Blacksmiths' Association will hold its 29th annual convention at the Hotel Winton, Cleveland, Ohio, on August 18-19-20, 1925. A very large attendance is expected for the meeting this year is going to be even more interesting than the last one. Discussions will be in order on economical methods and on the art of blacksmithing. It is also planned to consider the most modern appliances of all kinds suitable for railroad blacksmith work.

SUTTON-RAYMOND CORPORATION FORMED AT INDIANAPOLIS

Mr. Charles R. Sutton, formerly proprietor of the Sutton Welding Products Company, Indianapolis, and Mr. Henry I. Raymond, Jr., of Indianapolis, have recently formed the Sutton-Raymond Corporation which will start business immediately at 319 West Maryland Street, as dealers in welding equipment and supplies and will also operate a job repair and production welding shop in connection with the business. Mr. Sutton has been in this business in Indianapolis for a good many years and has been prominent in the welding equipment field since 1913. Mr. Raymond has been active in the metal trades in Indianapolis and has a large acquaintance among the industrial men of that city which will be useful to the new firm. It is stated that Mr. Raymond will act as Secretary and Treasurer of the new corporation. Both Mr. Sutton and Mr. Raymond were in Chicago during the week of July 13th and in the course of their visit made arrangements with the Torchweld Equipment Company to carry the Torchweld line of welding and cutting apparatus for the Indianapolis district.

PRODUCTION WELDING FOR SMALL SHOPS

Job welding shops commonly find a good deal of profitable production welding is possible in the fabrication of sheet metal containers of all kinds, but since research has been directed to the welding of structural shapes several enterprising

Welded Automobile Greasing Rack.

welders have seen the possibilities of new fields of production work. Two interesting photographs have been received from the oil region of Oklahoma. One of them shows a tank support and the other an automobile greasing rack. Although no tests have been made to determine exactly the strength of these devices, it is stated that enough of them have been put in service to prove that they give perfect satisfaction, and

An All Welded Tank Support.

seem to be even stronger than riveted products of the same type. Welding results in a stronger, neater and more satisfactory job with a saving of approximately one-third on labor. There are no holes to lay out which must match up, no holes to punch and fit up, and after the welder has tacked the different parts into place he needs no helper, whereas it takes three men to handle a riveting job. In the jobs shown here welding is not used for all of the joints because these products have to be taken apart for moving or shipping, but wherever it has been applied the advantage has all been in favor of the welded one piece construction. Incidentally, the tanks in the background of the photo of the grease rack are all welded tanks of over ten thousand gallon capacity.

LOCAL MEETINGS OF AMERICAN WELDING SOCIETY

National body plans help for Section Chairmen and Paper Committees

The National Meetings and Papers Committee of the American Welding Society has just announced tentative plans for assisting local sections during the coming year in securing suitable papers and speakers for section meetings.

As has been the practice for several years this Committee is making arrangements with a number of manufacturers of welding equipment and supplies and with various users of welding for papers and speakers to be available for local section programs. In addition to this it is intended to offer assistance in developing programs devoted to several of the fundamentals of welding which merit special consideration. These are:

a. Determining the qualifications of the welder.
b. The material and its inspection.
c. Design and layout of the material for welded joints.
d. Preparation of the material for welding.
e. Welding technique (including organization of personnel and sequence of operations).
f. Method of test of completed job and strength and tightness of welded joints.

It has been suggested by the Committee to Section Chairmen that at least two meetings during the coming season be devoted to developing information on these subjects. It will be noted that any one subject can be treated from many interesting angles, and that a meeting given over to one of these headings would be likely to bring out valuable experience and enlightening views from users of all welding processes, as well as representatives of manufacturers of welding equipment and supplies.

For example, sub-heading "C"—"Design and layout of material for welded joints" could be covered from many angles with relation to the particular *material* used for welding, whether sheet metal, heavy plate, cast sections, steel pipe and so on; other aspects have relation to the welding *application*, such as building of small tanks, building of pipe manifolds and fabricated piping, or repairing heavy castings. Such papers and the discussion prompted by them would, without doubt, bring out constructive information without involving the least controversy between processes.

On the other hand, a common and typical job could be discussed from all of these several angles. Such a meeting would be likely to develop, with relation to the welding of pipe joints for instance, the necessary qualifications for the welders and so on down the list.

It is felt that the development of this program in meetings of the various sections of the American Welding Society will produce papers and discussions of a constructive nature that will add vastly to the store of practical information on the technique and the applications of welding by all of the various processes used. A digest of the facts brought out, made available by the American Welding Society to the welding industry to users of the various processes, to engineers, architects and designers of welded equipment and to others interested should be of distinct help to the welding industry.

SEMI-ARC OR LC WELDING

Semi-arc welding is not intended and should not be used for such work that requires continuous arc welding, as the welding of broken frames, rear axle housings, tire carriers, etc., of automobiles, or repairs to large castings as presses, punches, tanks, boilers, piping, etc. In semi-arc welding the arc is not continuous, but of the make and break, on and off. The principal trouble encountered in the welding of cast iron, when employing the full or continuous arc method is the contraction of the filler rod generally employed, causing deposited metal to pull away from the cast iron as well as making cracks across the deposited bead at frequent intervals before cooling; this unavoidable trouble is particularly noticeable on thin cast iron sections such as automobile cylinder blocks, but is eliminated to a great extent by employing the semi-arc method and a nickel filler rod. This method of deposit and the nickel filler metal permits the contraction to take place in each globule of metal deposited, thereby eliminating the two feature difficulties described. The amperes and volts which are utilized intermittently in this method of welding are considerably higher than those of the full arc process. It is claimed that this results in fusing each drop to the parent metal at adequate penetration.

JOHN BRANT IN BLACK HORSE TRYOUT

John Brant, vice-president of the Indiana Oxygen Company, along with Henry Booth, sales manager of the Shawinigan Products Corporation, accompanied by Mrs. John R. Brant

The Big Horse Is Easy for This Rider.

and Miss Helen Booth, recently spent a week in Canada visiting the Canada Carbide Company. In the course of the week Henry's camera caught John in the act of displaying his horsemanship in a ride on the most famous Canadian horse.

WHARTON CONDUCTS CYLINDER TESTS

Wm. Wharton, Jr., & Co., Inc., for the past eighteen months, have been conducting an extensive series of tests, hydraulic, physical and metallurgical, on both new and used cylinders of various makes, for the purpose of checking up on present I. C. C. specifications governing cylinders, including both those relating to manufacture and to subsequent five-year tests of cylinders.

These tests have been conducted under the direction of Dr. H. E. Sturke, former Chairman of Tests and Specifications Committee of the Compressed Gas Manufacturers Association. Metallurgical and microscopic tests were under the direction of John H. Hall. Physical tests were made by Columbia University.

Data of great value has been obtained which will soon be available for the benefit of the industry in its work for safety.

WIRE BRUSHES FOR WELDERS

C. Sorenson, 18 East 16th Street, Chicago, Illinois, who for a number of years has been manufacturing welding rod holders for oxy-acetylene welders, has announced a new product in the form of an all steel wire brush. These brushes are designed for use in shops for cleaning parts that are to be soldered, welded or painted, in garages for cleaning, tubes for tires or patches, spark plugs, battery terminals, old aluminum step plates and cleaning carbon and rust from all metal parts. The brushes are machine made of good material with a galvanized sheet steel handle and back wires clamped in by a new process. They are supplied in two sizes, one 9 inches over-all and the other 11 inches over-all. The retail price is 35c for the small size and 45c for the large size. Special discounts are given to dealers in the welding supply trade.

News of the Welding Trade

A new plant is soon to be put in operation by the Copper Welding Corp., Pittsburgh, Penna., who recently leased a foundry for this purpose.

The Bierman-Everett Foundry Company announces the installation of additional equipment in their brass and aluminum factory in Irvington, New Jersey, which they say will considerably increase their facilities for rendering prompt service.

At the Chemical Equipment Exposition which was held in Providence, Rhode Island, during the week of June 22nd, over a thousand technical and industrial visitors from the United States and abroad were registered. The Exposition was held throughout the week and following its close the Board of Directors of the Association of Chemical Equipment Manufacturers instructed the immediate preparation of a survey of exposition buildings and cities,

available dates, etc., to determine plans for future equipment shows.

Parker B. Francis of the Kansas City Oxygen Gas Company was a visitor in Chicago, July 8th.

Lorif Campbell, Jr., of the United States Welding Company, recently returned to the home office in Minneapolis after an extended trip through the East.

Fred Weitzel, E. G. Weitzel and A. P. Weitzel of Pittsburgh recently incorporated the Welded Body and Tank company for the purpose of manufacturing, repairing and selling new and used bodies, tanks, machinery, etc.

H. S. Mann, formerly district manager of the Metal and Thermit Corporation in Chicago, has recently resigned to accept the position of District Sales Manager of the Standard Stoker Company, Inc. Mr. Mann has been with the Metal and Thermit Corporation since 1907, and has been District Manager in Chicago since 1913. He has been very active in the affairs of the American Welding Society, particularly in promoting the activities of the Chicago Section.

W. G. Stanton and Richard M. Crosley have organized the General Welding Company, 80 State Street, New Haven, Conn., and have plans made to operate a repair and production welding plant.

Keith Dunham Company of Chicago reports the installation of a double Oxeco oxygen producing unit at Pitcairn, Penn., and also the installation of an Oxeco plant for the Burdett Oxygen & Hydrogen Company, Chicago, Illinois.

Announcement has been received of the incorporation of the Ajax Airlyte Welded Products Company, New York City, a commercial welding plant. The incorporators are J. J. Thornley, R. T. Marsh and G. W. Geiling.

It is reported that the Prairie Pipeline Company, Tulsa, is planning to lay a 36-mile welded pipe oil line from Cromwell to Shawnee, Oklahoma.

The plant of the Phoenex Tool Company at Warren, Ohio, which has been lying idle since that company went out of business a couple of years ago, was recently purchased by the American Welding & Mfg. Company of Warren. It is reported that the new owners will operate both plants for the time being, but will probably combine both of them at the new location some time in the future. J. C. Manteich is president of the American Welding and Mfg. Company.

O. E. Engler of the Balbach Oxygen Company, Omaha, Nebraska, was a visitor at the office of the Gas Products Association, Chicago, June 19th.

Among the June brides of the welding industry are Mrs. A. L. Augur and Mrs. W. J. White, both of whom officially became members of the oxy-acetylene family last month. Mr. Augur is in the Sales Department of the Bastian-Blessing Company and Mr. White is District Manager of the Burdett Manufacturing Company, Chicago.

The North Branch Electric Welding Co., Inc., is the name of the new organization which will conduct a commercial welding business at 1500 Kingsbury St., Chicago, Illinois.

The Westinghouse Electric & Mfg. Company have torn down a number of small buildings at their East Pittsburgh works to make room for the erection of a new 11 story office building costing approximately a million dollars.

The Chicago Steel and Wire Company have made arrangements for representation in California with R. O. Waldman at 200 Davis Street, San Francisco, who will carry a stock of Weldite rods in that city.

A. J. Russell of the Bettendorf Oxygen-Hydrogen Company, C. O. Epperson of the Compressed Gas Company of Denver, and W. H. Girdler of the Kentucky Oxygen-Hydrogen Company, Louisville, were visitors in Chicago, early this month.

New officers of the British Welding and Acetylene Association are W. Baker of the Acetylene Corporation, President, and Mr. Walter Yates of Mathews and Yates, Ltd., Vice-president.

J. A. Rosch, Jr., has been elected President of the Steel Sales Corp., Chicago, to succeed Albert B. Dorman who died on June 27th. Mr. Rosch was formerly Vice-President of the Corporation. F. W. Walters was elected Vice-President and General Sales Manager and D. R. Hoffman, Secretary and Treasurer.

O. Simonis, Managing Director, Liquid Air., Ltd., London, is making an extended visit in the United States and is planning to attend the convention of the Gas Products Association this month.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

Position Wanted — All-around oxy-acetylene and electric welder who also is an experienced machinist and at present employed wants a new connection. Have had plenty of practical experience and can furnish the best of references. Address 61, care The Welding Engineer.

For Sale—Only exclusive welding shop in thriving town of 16,000 people. One of best locations in the northwest. Best of equipment, good business. This shop should pay for itself in twelve months. Address F. E. Bliss, 508 Washington street, Vancouver, Washington.

Position Wanted—All-around acetylene and electric welder, ten years' experience, would like to connect with a welding supply company as demonstrator. Address 68, care The Welding Engineer.

For Sale—A well established welding works in Flint, Mich., doing a good business. Owner wants to leave city. Address 69, care The Welding Engineer.

For Sale—Oxy-acetylene and Spring Repair shop. Good location; no competition. P. O. Box 471, Somerset, Pa.

For Sale—The service rights on a limited number of W. K. and W. C. Prest-O-Lite cylinders. Address Remington Arms Company, Inc., Bridgeport, Conn.

SALES EXECUTIVES

The Alexander Milburn Company, in line with its policy of expansion, have openings for one or two high grade sales executives, competent and experienced, to take care of salesmen, jobbers and territory, embracing a number of States. Address The President, The Alexander Milburn Company, Baltimore, Md.

For Sale—New Ark alternating current electric welding machine; excellent condition; new $625; $225 takes it. Sussex Welding Co., 153 Sussex Ave., Newark, N. J.

Position Wanted—First-class welder with experience in pipe line, heavy repair and tank work, wants to get in touch with large construction welding operations in New York, New Jersey or Pennsylvania. Married; now employed, but desires to make a change. Address 70, care The Welding Engineer.

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We desire distributors to sell and supervise the sale of our electric arc welding equipments. Unusual money-making opportunity for men who are qualified and familiar with arc welding and its applications. A worth-while connection. Further particulars upon request.
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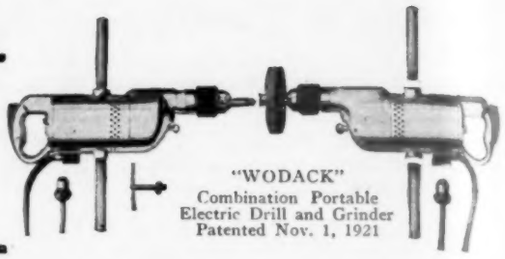

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Patented Nov. 1, 1921

CURRENT WELDING LITERATURE

REACTIONS, Quarterly publication of the Metal & Thermit Corporation.—The current issue contains a story of Track Reconstruction carried on last year by the Birmingham Electric Company approximating ten miles of single track in a street which was part of the state highway system; a story of how four compromise joints were made with a single welding operation; how the thermit process is used in the installatoin and repair of crossing, switches, joints and special work in Youngstown, Ohio; how the thermit process is used in the reclamation of locomotive main rods.

FIRE BRIGADE EQUIPMENT, by A. B. Harrower.—The use of acetylene lamps on fire engines to save wear on batteries. Description of the cutting apparatus supplied to fire brigades and details of its usefulness to the fire department.—The Welding Journal, London, June.

METHODS RESPONSIBLE FOR THE SUCCESS OF THE WELDING DEPARTMENT OF THE PRAIRIE PIPELINE COMPANY.—Experience of this company has shown that a long period of training is necessary and that the original ability of the man is an important factor. Therefore, helpers of known ability are gradually trained as welders and much care is used to develop individual skill on the part of every operator. A careful check is made daily on the work of the welders and all the operations are standardized as far as possible.—Acetylene Journal, July.

OXY-ACETYLENE CUTTING IN CONNECTION WITH BUILDING CONSTRUCTION.—A description of some of the uses to which the oxy-acetylene cutting torch is put in the construction of modern skyscrapers.—Acetylene Journal, July.

WELDING IN THE ENAMEL LINED TANK INDUSTRY, by W. B. Miller.—Since these welds are made on the inside of the tanks the welds being ground off flush with the plates defects in welding operations result in blistering the enamel over the welds. Therefore, it is very necessary that the welds be perfect. Best results have been obtained by using the backward method of welding.—Acetylene Journal, July.

METHODS AND PROCEDURE IN WELDING STEEL.—Lectures and exercises covering the preparation of the metal and the proper manipulation of the torch for making welds in test plates on steel plate.—Acetylene Journal, July.

OXY-ACETYLENE TIPS, Monthly publication of the Linde Air Products Company.—The June issue contains the following articles: Cutting Blowpipe Aids Bridge Work, Service Protects Big Repair Work, Heavy Cutting in the Steel Foundry, Procedure Control for Oxwelding Monel Metal Castings, Are Welded Joints Good Joints, Fabricating Ferry Boat Rudders, Oil Refinery Condensers Made From Steel Plate, Emergency Repair of a Cast Iron Pipe.

ARC WELDING IN STEEL MILLS, by R. L. Scollard.—Arc welding keeps down the overhead by eliminating the continuous purchase of new equipment to replace broken or wornout machinery which it is possible to reclaim quickly and cheaply. The article gives several instances of the saving made possible in the steel mills by using the arc to reclaim such machinery.—Blast Furnace and Steel Plant, July.

PROPER PREPARATION FOR BOILER WELDING, by A. F. Dillon.—Methods of comparing patches in flues for welding boilers. Illustrations show the preparation for fire box doors, flue sheet flanges, mud rings, full size patches, door holes, back flue sheet patches and flues.—Railway Purchases and Stores, July.

WELDING PRACTICE AND INSPECTION IN SHIPYARDS, by W. P. Hough.—The methods used in shipyards for the inspection of electric welding and for testing the skill of arc welders. The work is divided into two general classes. first, the work in connection with the construction; and, second, the work in connection with correcting defects in material.—Journal of the A. W. S., June.

DETERMINING AND INCREASING THE SKILL OF WELDERS, by G. O. Carter.—It is shown that welding experience is not a correct guide for the selection of welders so an actual proficiency test is necessary to properly qualify the welders. It is important the welder be able to make a good weld not only when he is working undisturbed, but also when inspectors or foremen are watching him. On important jobs it is necessary to test the welder's ability by means of samples to make sure that he knows how to obtain good fusion and thorough penetration.—Journal of the A. W. S., June.

FUSION WELDING AND CUTTING AS PRACTICED ON THE A. T. & S. F. RAILROAD, by E. E. Chapman and H. H. Service.—A description of the organization of the Welding Department on the Santa Fe lines and a list of the important fundamental rules and regulations which are supplied to each welding operator, together with descriptions of tests which are made to determine the possibilities of welding operations and the efficiency of individual operators.—Journal of the A. W. S., June.

THE INSPECTION OF WELDS IN PRESSURE VESSELS, by S. W. Miller.—There is small basis for the claim that riveted joints can be inspected more thoroughly than welded joints. Inspection of railroad joints must cover design, material and workmanship. The inspector must know when a good weld is being done. There are certain observations which may be made regarding the completed job as a result of visual inspection of a weld which indicate its quality.—Journal of the A. W. S., June.

CONSTRUCTING WELDED STEEL SMOKE STACKS, by T. C. Fetherston.—Comparison of riveted and welded stacks and practical suggestions for carrying out welding operations. Methods used for assembling and erecting welded stacks.—The Boiler Maker, June.

SUPERFICIAL CHANGES IN METALS AND INDUSTRIAL ALLOYS, by G. LaGrix.—A study of the changes which are made on the surface of metals and alloys showing that although they are extremely slight yet they have a different and sometimes an extremely troublesome effect when it becomes a question af fabrication by welding.—Revue de La Soudure Autogene, May.

LEAD WELDING IN BATTERY BUILDING, by H. Boutte.—A brief history of the development of the process of welding lead and a description of the methods employed today. Details and illustrations of the application of the lead welding to the assembly of storage batteries.—Revue de la Soudure Autogene, May.

SOME APPLICATIONS OF ACETYLENE WELDING.—An interesting series of photographs showing how welding is used for making bases, ornamental iron work, metal furniture, metal wagons, pipe and tube shapes, stoves and automobile bodies.—Revue de la Soudure Autogene, May.

PROGRESS REPORT NO. 3 OF THE COMMITTEE ON WELDED RAIL JOINTS.—A summary of tests and reports since the publication of Report No. 2, March, 1924. Description and illustration of a series of tests on rail joints made by different processes.—Journal of the A. W. S., May.

THE WELDER'S GUIDE.—A 44-page pocket size booklet printed in two colors published by Steel Sales Corporation, Chicago, Illinois. The booklet contains a complete list of the welding rods and wire supplied by the Steel Sales Corporation and is supplemented by a series of instructions and suggestions for welding all commercial metals, both by the oxy-acetylene and electric arc process, together with special suggestions for such jobs as pipe welding, tank welding, boiler welding, etc. Helpful suggestions are given to the welder in selecting proper welding rods and wire for particular jobs. The booklet is illustrated with photographs and drawings and shows some of the important principles governing correct welding operations.

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Lightest Welding Goggle Made

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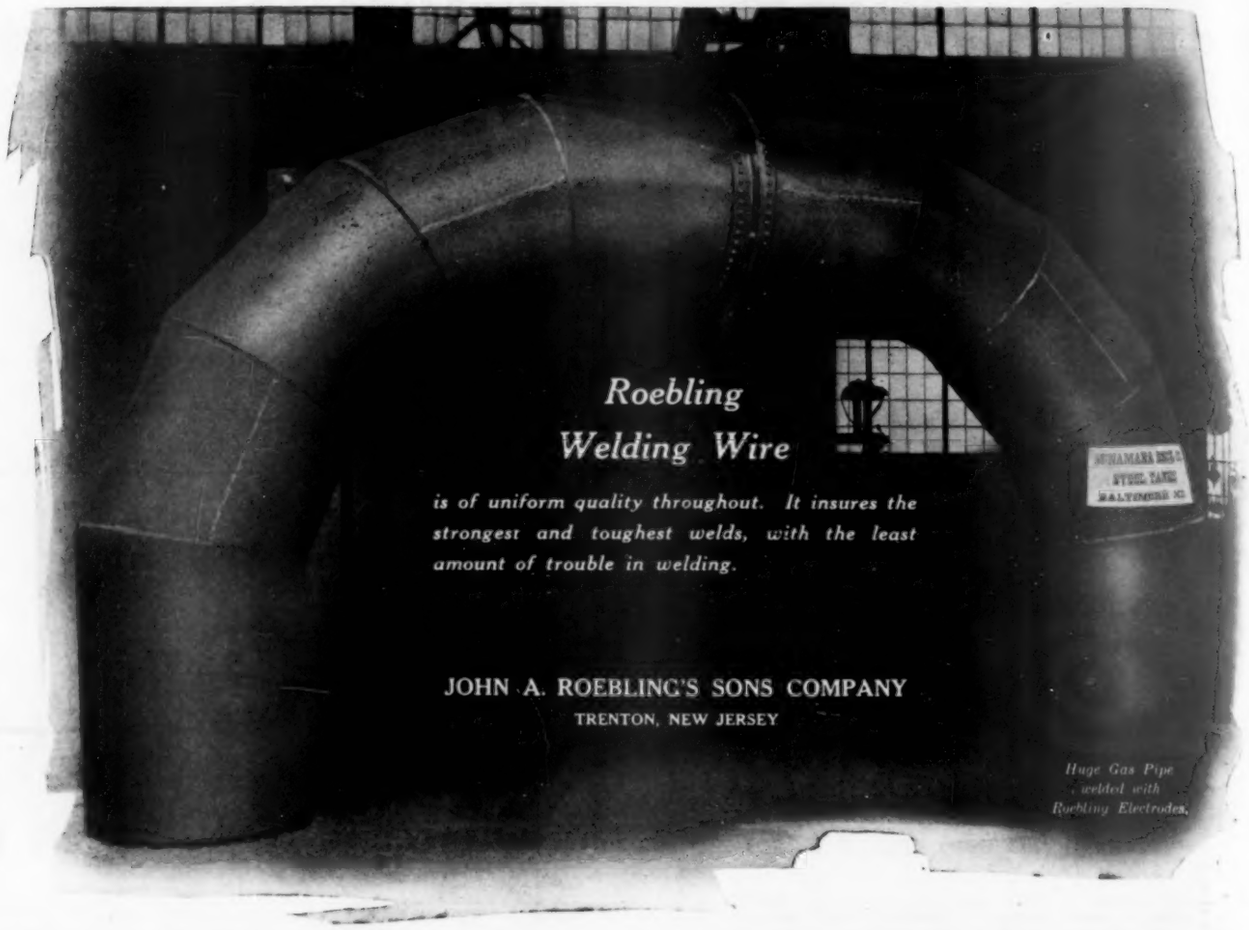
Atlanta—512 Austell Building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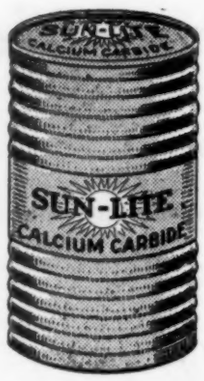

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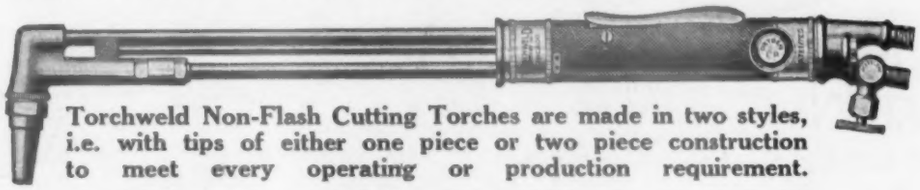

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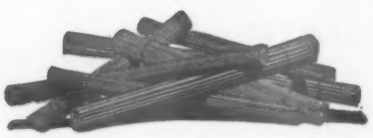

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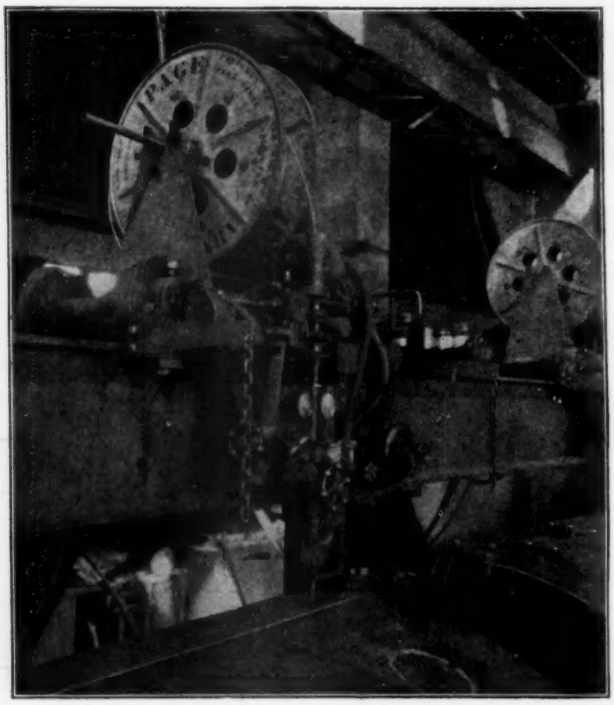

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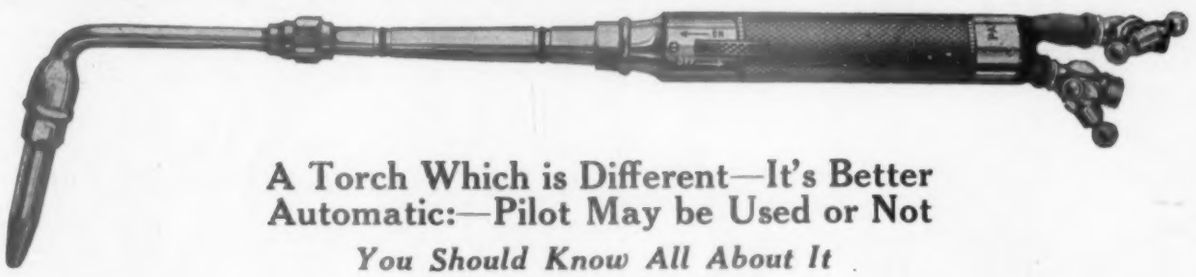

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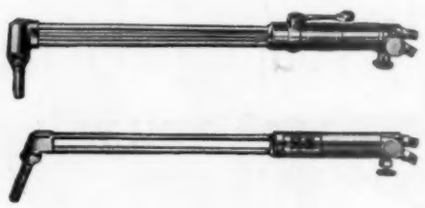

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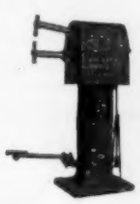

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